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Horizontal Drilling Machines—II.

BY JOHN RANDOL.

Figs. 5, 6, 7 and 8 are different views of the vertically adjustable saddle of the De La Vergne driller. The same letters refer to the same parts throughout.

The vertical splined shaft *G* is journaled to the saddle at *X*, and carries below the journal a bevel pinion meshing with two facing bevel gears loosely mounted on the drill spindle *L*. Splined to *L*, between the two loose gears, is a sliding clutch co-acting with either or neither of the spindle gears, according to its position as governed by the hand lever and its keeper segment and latch, all as clearly shown in the engravings. By this arrangement the spindle is reversed, so that both drilling and tapping can be done with the main spindle. As originally arranged, the spindle ran only one way, the change for tapping having been made by Mr. Aui, superintendent of the De La Vergne shops, as before stated. The hand wheel *O* is fast on the hollow feed shaft *Q*. The spur gear *M* is fast on the drill spindle *L*, and meshes with the spur gear *N*, which is loose on the shaft *Q*, but can be friction clutched to the hand wheel *O* by means of the two-handled nut, as clearly shown in Fig. 7. The gear *N* runs loose for the hand-feed, and is tightened to *O* for the power feed. The hollow feed-shaft *Q* carries three loose pinions *R* at its rear end, which mesh respectively with three spur gears fast on the feed screw. To the feed screw an open and shut nut is fitted, governed by the horizontal lever seen projecting in front from the sliding block *T*, which carries the split nut. The drill spindle *L* is shouldered down and journaled in the sliding block *T* with a nut and washer at the rear, so that the drill spindle is carried back and forth by the movement of the sliding block. The chain *W* is bolted to the underside of the sliding block *T*, and is carried to the rear around an idle sprocket, and then forward around another sprocket on the shaft of the quick spindle adjustment wheel *U*. Either of the three loose pinions at *R* may be clutched to the hollow feed shaft *Q* by the push rod which is seen projecting from the shaft in front, at *P*. The saddle is balanced by a weight which moves up or down in the hollow at the rear of the pillar. The spindle *L* is about 2¼ inches diameter only. The saddle is raised or lowered by means of the hand wheel *J*, fast on a cross pinion shaft, the pinion working in a vertical rack secured to the pillar. This cross-shaft is locked by the hand-actuated friction nut *K*.

The work carriage is four-wheeled, and the front wheels are both on one shaft. This shaft carries a pinion at each end, close to the wheels; these two pinions mesh with two racks, which I think are made in one piece with the rails. This pinion shaft is operated by a bar placed in capstan holes in a hub fast on the end of the pinion shaft next to the pillar. The traveling table is heavy enough to carry 25 tons safely. The first carriage used with this machine was too light, and broke in two with a 25-ton piece on it. The top of the table is planed and is pierced with 2-size bolt slots, so as to take bolt heads through from the top. Angle plates and angle frames and parallel blocks are provided in abundance, so that any job can be very quickly set on the table. Back boring, or facing up under flanges for bolt heads or nuts, has to be done with the hand feed, as the machine feed does not reverse. The great fault with this driller is its drive, which takes more head room than is to be had on ordinary floors, and makes a change of speed difficult. The saddle and spindle handling arrangements are simple and good, and consist entirely of spur and bevel gears, except the chain for the quick hand adjustment.

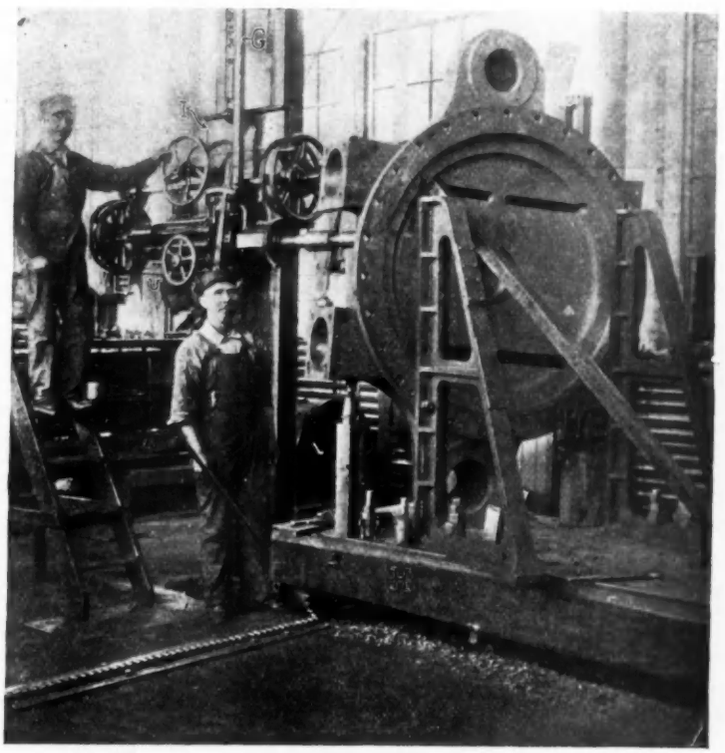

Fig. 5. THE CORLISS DRILLER.

I add a sketch of an electric-driven driller, by way of suggestion. As I do not see much room for improving the saddle and spindle drive and feed works of the De La Vergne driller, I would keep that part of the machine as it is. The changes proposed in the drive, as shown in the

sketches herewith, Fig. 9, make changes of speed easy, and reduce the head room to its lowest dimension, while the change in form of the pillar is such as to make the bracing at the top needless.

In Fig. 9 the countershaft is placed on the base of the pillar, the pillar being changed to the box form, and the base being sufficiently extended to give the pillar a good support, thus avoiding top bracing. The motor 15 stands on a bracket bolted to the side of the pillar. From the motor shaft 12 power is transferred through a pair of spiral gears to the vertical shaft 6, and from the vertical shaft to the counter-shaft 3, through a second pair of spiral gears 6, 5, as shown in plan. This gives a double spiral gear reduction between the motor and the countershaft. The countershaft 3 carries three speed-change gears 1, 1, 1, fast on it. These change gears mesh with three other change gears, which run loose on the hollow shaft 4, unless one of them is clutched to 4 by the push pin 7. The front end of this change shaft 4 is carried in a flanged bush 8, set in a cored way in the pillar. A pair of mitre gears at 20—21 transmit motion to the vertical splined shaft 22, supported at its lower end in the bracket 9. The splined shaft 22 carries the sliding spur gear 10, which is always kept in mesh with the gear 11, which is fast on the vertical shaft *G*, which takes the position of the spline shaft *G* in Figs. 5, 6 and 7, and carries the bevel pinion which drives the drill spindle *L* in either direction, by means of a pair of loose bevel gears, 23, 24, meshing with the bevel pinion on the lower end of *G*, same as in the De La Vergne driller.

It is to be understood that Fig. 9 is the merest sketch, designed to show the drive proposed, with as little drawing as possible. The front wheel shaft, by which the carriage is moved with a capstan bar, should have a reducing gear applied to it to give about four turns of the capstan to one revolution of the wheels.

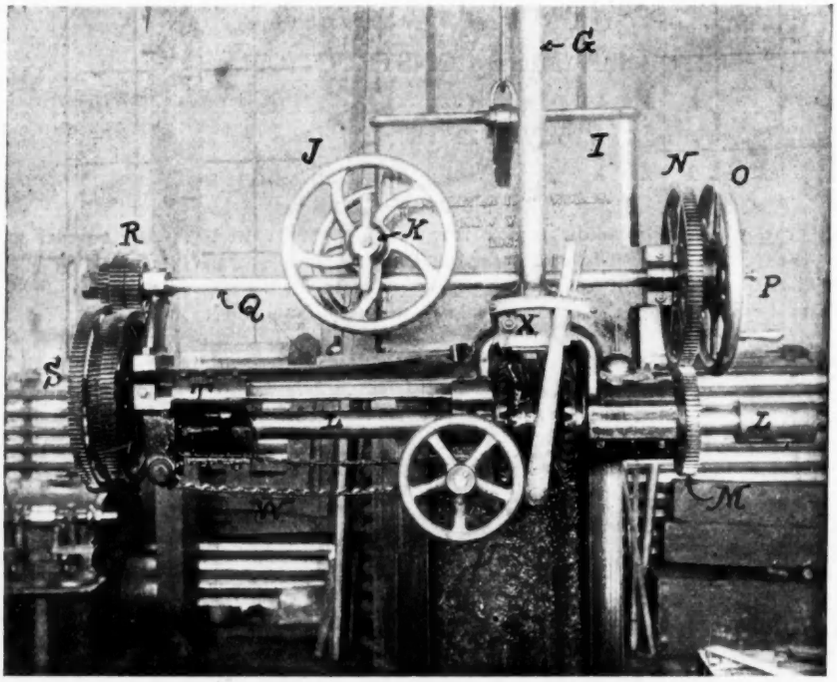

Fig. 6. THE CORLISS DRILLER SADDLE.

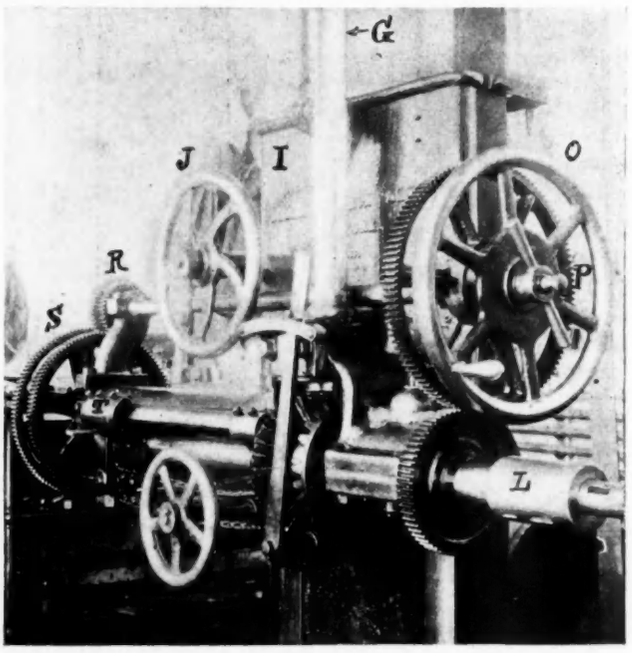

Fig. 7. ANOTHER VIEW OF THE SADDLE.

With the direct action, the carriage is hard to move when carrying a piece weighing 5 tons. As the carriage is moved to give the side adjustment for drill location, it should be so geared as to move easily and smoothly.

The horizontal driller shown in Fig. 9 is entirely self-contained, and can have 10 feet vertical adjustment of the drill spindle, with 14 or 15 feet of head room. The drill spindle center should drop to within about 2 inches of the top of the carriage, and, to cover large steam engine and pump work, should have at least 120 inches vertical adjustment.

The De La Vergne drill taps holes up to 6 inches diameter, and will turn a 2½-inch drill up to the limit of its strength. Drills of this class are often used for boring machines, especially for built-up 2- and 3-throw engine cranks. The large table is very convenient for this purpose; and a small shop, which has hardly work enough to warrant the purchase of an expensive boring machine, is economically served by a horizontal driller which can do boring up to 10 or 12 inches diameter, besides all ordinary drilling. If arranged with a view to boring, probably it would be better to use four pairs of speed change gears, rather than three, as shown in Fig. 9, and some outboard support for the bar would be needed, which should, perhaps, preferably be arranged to be clamped to the work itself, when needed.

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Volume and Pressure of Air for Foundry Cupolas.

At the February meeting of the Western Foundrymen's Association in Chicago, an interesting discussion was had upon the following question: What is the proper amount of air, and pressure of same, to melt iron in the cupola, and what are the effects of too much and of too little air? We condense to the briefest outline the remarks of each speaker.

Mr. Sarge—Assuming a blast pressure of

8 ounces, and 7 pounds of iron melted per pound of coke, the ordinary practice is to assume a consumption of 2,500 pounds of air per 2,000 pounds of iron melted.

Mr. Smith—In my experience 8 ounces is about the best pressure. In our foundry we used a No. 7 Sturtevant fan at 2,200 revolutions, but a No. 8 at 2,000 or a No. 9 at 1,900 would do the same. Too little blast does little harm, especially at the beginning of the heat and with soft iron. Excessive blast melts faster, but produces colder iron and has a tendency to harden it. With the same charges throughout, the first iron is apt to be harder than that coming later.

Mr. Pettigrew—When the cupola is dry and in good shape, the iron is softer at the beginning of the heat. In car-wheel foundries, with heats of 36 to 40 tons, they charge more hard iron in the middle of the heat that at either end.

Mr. Dalton—I have seen cold iron come at the first tap of cupola, growing hotter later, probably due to the condition of the cupola more than to the amount of air used.

Mr. Smith—The iron trickles through the charge as water through a sponge; if too much air is used the oxygen of the air acts on the iron and the tendency is to harden by forcing out the silicon. Too much air also chills the charge at the opening of the tuyere, preventing a good circulation of air, and also preventing good melting.

Mr. Hanna—We use 15 to 16 ounces blast. In the 32-inch cupola we melt about 4 tons per hour; in the 40-inch, 6 tons; and in the 60-inch, 12 tons. We blow into the three cupolas 3,520, 5,480 and 7,920 cubic feet of air per minute. The 32-inch cupola runs on hard iron for chilled work, and the others on gray iron. If 2,500 pounds of air melts 2,000 pounds of iron, we are using a very excessive amount.

Mr. Ferguson—I use as much air as possible, never had too much. Our plant may not be able to furnish an excess of air, but up to the blower capacity I want all the air. As I increase the blast I increase the speed of melting. Our iron is harder at the beginning of the heat. Ten years ago I experimented with low blast pressure to my heart's content. In a 30-inch cupola, with 8 ounces of blast, I melted 3 to 5 tons easily with a ratio of 1 to 7. I reduced the blast pressure and the amount of coke down to 4 ounces blast, and a ratio of 1 to 11½; then I stopped, as my iron was growing too cold.

Mr. Sarge—If the pressure is reduced the volume of air should be increased, and the tuyere openings should be enlarged also. Mr. Hanna's pressure is too high for economical results. With high pressure and a small tuyere opening the air acts on the fuel like a blow-pipe, giving intense heat at one spot and burning the coke away rapidly, leaving holes where the cold air enters and reaches the center of the cupola.

Mr. Thompson—The blast gage does not tell the story of the air used unless you have a positive pressure blower. With a fan the air delivered is not a positive quantity. We have a 54-inch Colliau cupola lined up to 48 inches, and with a Root blower delivering 8,000 cubic feet of air per minute we melt from 12 to 13 tons at a heat and use 40,000 cubic feet of air per ton. With more blast the iron is neither colder nor hotter but melts faster.

Mr. Carter—I have gone over some of the figures. Mr. Sage thought 2,500 pounds of air per ton of iron were used. Mr. Thompson used about 4,000 pounds for the 32-inch cupola, 4,100 pounds for the 40-inch, and 3,000 pounds for the 60-inch. There is, therefore, very close agreement when differences in blast pressures are considered.

Mr. McArthur—Does the amount of air depend upon the character of the fuel used.

Mr. Jackson—Where the coke is soft

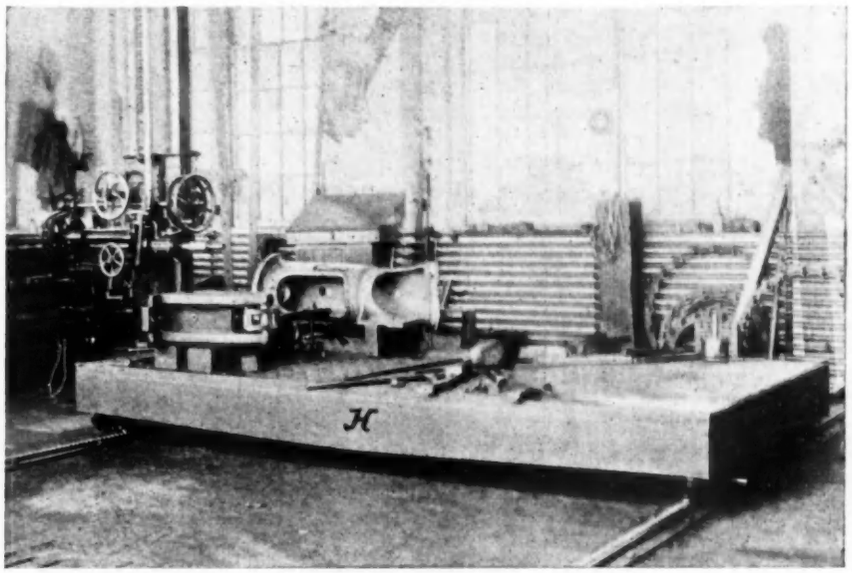

Fig. 8. DRILLING ENGINE FRAME FLANGES.

less pressure is needed and greater volume than for hard coke, so the soft coke should have a larger tuyere area.

Mr. Hanna—A fan is not to be relied upon for cupola work, a positive blower is needed. My best results have been with a 30-inch cupola, a 2-inch annular tuyere extending clear around the cupola and with 10 ounces pressure I have melted 5 tons per hour. Low pressure and large volume are desirable if enough tuyere area can be had, but there are difficulties about that.

Mr. Ferguson—Theoretically we should melt 20 pounds of iron to one of coke, we do not on the average exceed 8 to 1; does not this show that we are not getting enough air?

Mr. Sarge—The small proportion of iron melted is due to the fact that after the fuel is consumed in the melting zone the gases pass up through various layers of fuel and the carbon dioxide, the product of perfect combustion, absorbs more carbon and is transformed into carbon monoxide. The heat value of this carbon monoxide, in other words, the amount of heat produced improperly, is much smaller than that produced by the fuel perfectly. We have imperfect combustion in the cupola, and a large portion of the heat value passes out of the stack.

Mr. Hanna—It is usually more economical to sacrifice fuel to save time and other expenses in running the cupola.

Mr. Carter—When Mr. Hanna used 4,100 pounds of air per ton of iron, 20 pounds of air were used per pound of carbon in the iron, and the melting ratio was 10 to 1. The theoretical consumption of air would be 13 pounds per pound of carbon.

Mr. Pettigrew—Mr. Moore, of Joliet, has a Colliau cupola with the usual tuyeres, and he formerly used Connellsville coke entirely. As, on account of the strike, he had to get coke of a different character, and, as he thought, inferior, he was at first unable to melt his iron properly. He finally took out the Colliau tuyeres and cut out large openings, simply increasing the tuyere area; then he reduced the blast pressure and increased the volume of air, and since then he has had no trouble in getting hot iron in good condition from soft coke.

Mr. Jackson—Foundrymen frequently are not accurate enough and do not know the conditions under which they work.

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Duplicate Sketches.

Mr. D. W. Sowers, of the Pope Company, motor carriage department, and recently with the Stamford Street Railroad, realizing the need, so often felt in the drawing room, of having duplicate sketches as well as the letter-book copy, has been experimenting to that end, and

has succeeded in gaining the point sought for, in the folowing manner:

The sketch is made on ordinary section paper, using copying ink, or the copying pencil, the latter, made by the Eagle Pencil Company, giving the best results, and is then copied into the copy-book in the usual way, care being taken that the copying is thoroughly done, as all depends on this copy.

Supposing the copy is made on page 290, a piece of oil paper, ordinarily used in letter copying is placed on the back of page 289. On this oil paper is placed a wet cloth. This cloth should be evenly wet, a good way of wetting it being to use a sponge or camel's hair brush. The oil paper and cloth having been placed in position, smooth page 290 over on the wet cloth and place the blank paper, on which the sketch is to appear, immediately on this; then another sheet of oil paper and the book is ready for the letter-press.

On putting the book in the press care should be used to open it wide enough to admit the book freely so as not to crumple the paper. Leave for a minute or two, and then take out using the same care as when putting the book in the press. Open the book at page 289 and remove the first sheet of oil paper and the cloth. Then gently draw back one corner of page 290. If the lines do not show up clearly, replace in the press, going through the same operations as at first.

With a little practice, copies can be made in this way which are hard to tell from the originals, five and six copies having been taken from the single tissue paper book copy. It would naturally be supposed that this process would tend to weaken the book copy, but the change is hardly perceptible.

The best paper for the blank is that which has a slightly glazed surface; that, in fact, used for the original being as good as any.

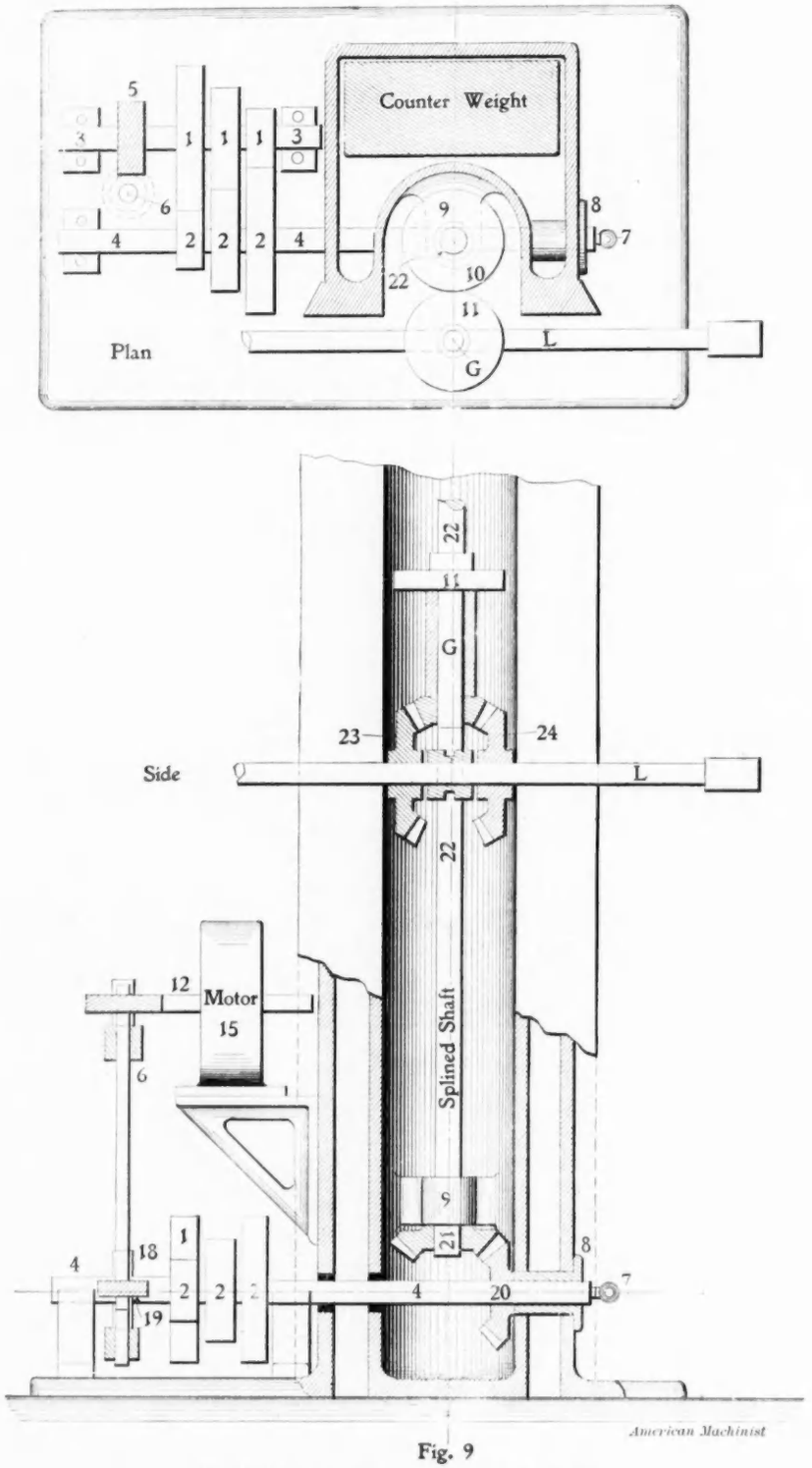

Fig. 9

ELECTRIC DRIVE FOR CORLISS DRILLER.

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Eccentric Gears.

BY FRANK RICHARDS.

I have recently had personal occasion, for a certain purpose, to look into the properties of two or three of the familiar "quick-return" motions, and I have a notion that some of the readers of the "American Machinist" might be interested in my investigation of the matter, or perhaps rather in the results attained. I speak here and now only of eccentric gears as employed for the quick return service.

I am inclined to think that the descriptive term "quick return" is rather a misleading one, because it tells only a part, and perhaps not the principal or most important part, of the truth concerning the mechanisms referred to. The quick return is accomplished undoubtedly, but an approximate uniformity of advance during the slow or working stroke of the machine where the device is employed is also secured, and this feature is perhaps as important as, or more important than the quick return, as we may be able to see.

Most of the shapers and slotters and similar machines upon which the quick-return motion is employed start out with the crank idea. On these machines the throw of the crank is adjustable for different lengths of stroke as required, and then the quick-return motion is supposed to be added to that just to save some of the time lost on the return stroke. The quick-return device, in the popular mechanical mind, is just equivalent to the quicker movement of the return stroke of the planer. But there is really more than this in the quick return business when employed upon crank actuated machines, and it ought to be more generally known and appreciated, and the knowledge might

perhaps promote the wider employment of the quick return.

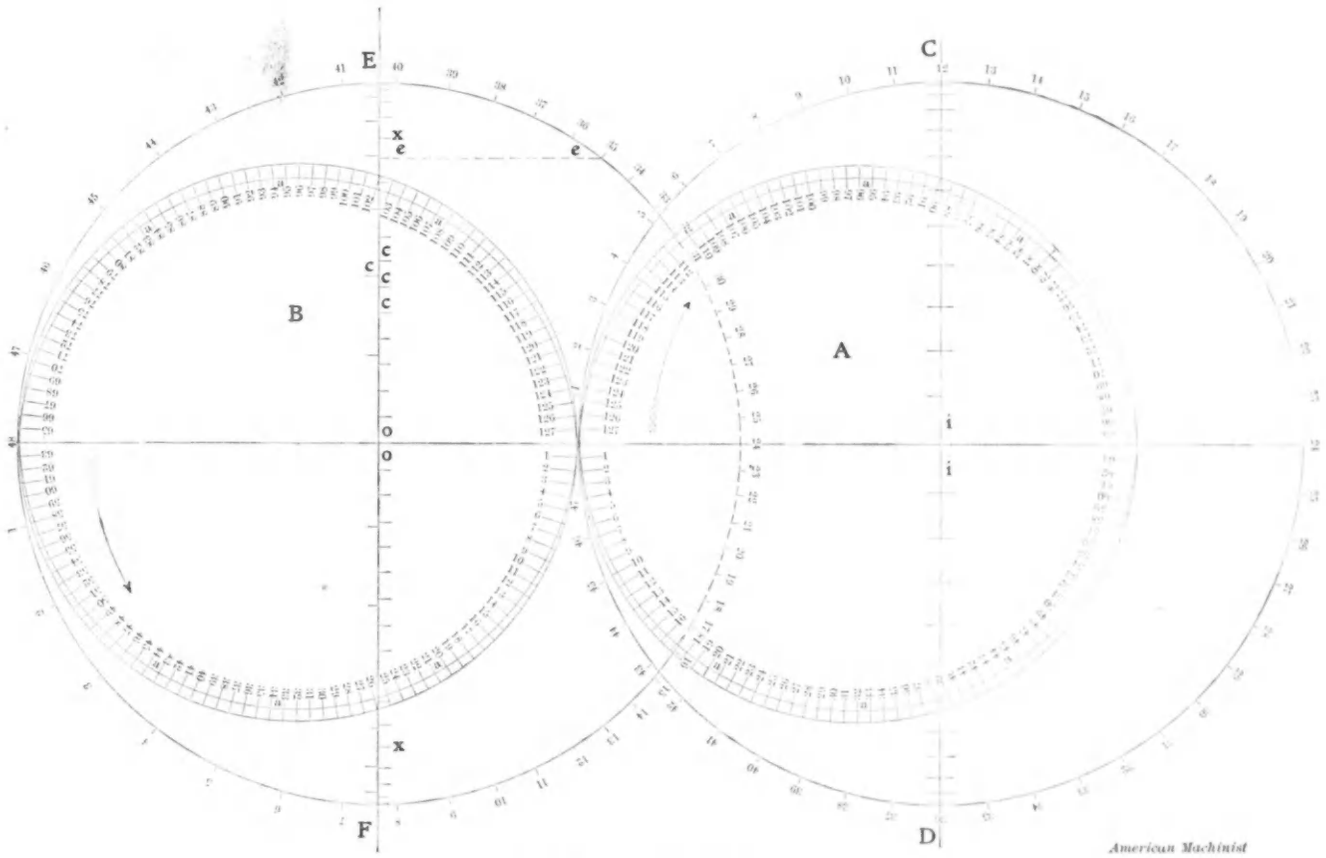
The movement of a planer platen is of course uniform throughout the cutting stroke, and the planer can therefore be run at its best speed all the while, or at as high a speed as the tool will stand for the whole stroke. Now it is not that way with a crank driven shaper; that is, with the crank on a shaft revolving at a uniform speed. The normal movement of a tool-carrier, if driven by a uniformly rotating crank, is never uniform. Of course the slide moves much faster in the middle of its stroke than anywhere else, and this high speed at the middle of the stroke sets the limit to the allowable speed of the machine. The speed of rotation of the crank shaft and the entire movement of the slide must be regulated so that the tool will not move too fast at the mid-stroke. This is a losing game. If the tool moves at a safe and permissible speed when in the middle of its stroke, then for the rest of its stroke it must be moving slower than necessary, and toward the ends of the stroke much slower. The average speed for the entire cutting stroke must necessarily be less than would be proper with a uniform tool advance, and the difference must mean time wasted, just as truly as the time used for the return stroke is wasted. It is here that the good offices of the "quick return" movement come in. It not only saves time on the return stroke, but it also saves a good deal of time on the cutting stroke, by giving the tool through most of its work a more uniform cutting speed, and especially by cutting down the high speed in the middle of the stroke.

The diagram reproduced herewith, one quarter size for the dimensions that will be given, will give a tolerably clear understanding of the operation of the eccentric gears. It will be very easily understood with a little explanation. Some little experimenting before the construction of the diagram had given some idea of the amount of eccentricity and some other proportions as most suitable for the present purpose. *A* and *B* are two disks each 12 inches in diameter representing a pair of eccentric gears, *A* being the driver, or the gear which turns at a uniform speed. Both disks have been divided at the periphery into 128 equal divisions. Any other number of divisions might be used, the more the better. Starting from the central line, the divisions all around each disk are successively numbered, the numbers on one disk running in one direction and those upon the other disk in the opposite direction, so that when the driver *A* is revolved, the disk *B* may be turned around until the numbers of the division lines upon the two disks coincide, and in this way determine the position of *B* for any turn that may be given to *A*.

The division lines extend inward upon the faces of the disks a half an inch. It would not do to just mark the extreme edges, because where the disks are turned from the central position shown, it is found that they begin to overlap each other. Eccentric gears have to be, in fact, somewhat elliptical instead of perfectly round. For the amount of eccentricity assumed in the present case the gears are about 11½ inches by 12 inches, instead of being 12 inches in diameter in every direction. The disks can therefore be trimmed off to the lines *a a a* as shown without losing the division marks.

The outsides of the disks are supposed to represent the pitch lines of eccentric gears. We assume 1¾ inches for the eccentricity, making the radii 7¾ inches and 4¼ inches. From the point around which each gear is to revolve circles are drawn, each 7¾ inch radius, or 15½ inches in diameter. The longer radius of each disk will then just reach this circle all the way around as the disk revolves. The circle at the right is divided into 48 equal sectors, of 7½ degrees each, and the dividing radii are numbered successively all the way around, beginning with zero at the central line where the disks touch.

Disk *A* is now turned as indicated by the arrow until its central line coincides with radius No. 1, and held stationary there by weights or otherwise. Disk *B* is then turned in the opposite direction until the numbered divisions upon its edge coincide and correspond with the divisions of disk *A*. As the long radius of *A* and the short radius of *B* are contiguous, the movement of rotation of *B* is, of course,



ECCENTRIC GEAR DIAGRAM.

considerably greater than that of *A*. The position of the long radius of *B* where it touches the outer circle is marked, and the mark is numbered 1. Disk *A* is then turned to No. 2, disk *B* is turned until its divisions coincide with those of disk *A*, and its position is again marked on the large circle and numbered 2. This operation is continued until both disks have made a complete revolution and reached again the starting point, their radii again forming a continuous straight line.

In going around the circle, while the successive movements of *A* were equal, those of *B* were not equal to those of *A* nor equal to each other. At the beginning they were considerably greater than those of *A* and when half way around they were considerably less, becoming greater again when approaching the completion of the revolution. If we assume that the shaft upon which and with which disk *A*, or a gear represented by it, revolves, carries also a crank, the crank would of course have the same alternately accelerated and retarded movement as the gear, and if driving a cutting tool it would thus give the slow cutting movement and the quick return desired. The crank might stand anywhere around the circle with reference to the center line of gear *B*, and the power might then be taken off from the crank in any direction. We assume the crank to coincide with the longer radius of *B* and to be equal to that radius in length and that it gives motion to a vertical slide or tool carrier, the central line of the diagram being assumed to be horizontal. We draw the perpendiculars *C D* and *E F* through the centers of revolution of the two disks *A* and *B* and lay off upon them by means of horizontal lines, such as the dotted line *e e*, the several points *c c c*, showing the actual vertical movement corresponding with each movement of rotation. The several vertical distances thus represented, and the sum of these distances for each half revolution of the disk, would of course vary with the throw of the crank, but the vertical travel for each angular movement would bear the same ratio to the total travel as here shown.

On the vertical line *C D* with the crank moving at a uniform velocity it takes the same time for one stroke as for the other. The crank, however, gives a much more rapid vertical movement at or near the middle of the stroke than near either end of it. Referring to *E F* for the crank driven by the eccentric gear the action represented is decidedly different. The times taken for the downward and the upward strokes are not equal. The downstroke, representing here the "quick return," takes a little less than 15½, we will call it 15½, of the 48 portions into which we divided the revolutions of the driving shaft, and the upward or cutting stroke takes the rest, or $48 - 15\frac{1}{2} = 32\frac{1}{2}$, instead of one-half of 48, or 24. Now to get some practical good from the quick return we can speed up the machine until the cutting stroke takes the same time as the cutting stroke of the crank with uniform motion. If we are running at 100 revolutions per minute with a crank of uniform rotation we can now make 24 : 32.5 : : 100 : 135 revolutions, and that will represent the gain as far as the quick return is concerned.

But now compare the highest speed of tool travel upon *C D* and upon *E F*, or the greatest distance traversed upward upon each for any single portion of the revolution of disk *A*. Compare the spaces *o o* with spaces *i i*. Here, although on *E F* the total time occupied for the up stroke is 35 per cent. greater than for the up stroke on *C D* the difference in speed in the midstroke positions is much greater than this. The distance traveled at *o* is only minutely greater than one-half of that at *i* and a little increase of eccentricity in the gears would bring it down to one-half. Now, as the allowable speed of the cutting tool is determined by the speed at midstroke it is evident that the tool driven with the "quick return" may make just double as many strokes per minute as the tool driven by a uniformly rotating crank, or the practical result, comparing one with the other, would be as though one had no return stroke at all.

I am inclined to consider eccentric gears the simplest of "quick-return" motions and in many respects the best, although perhaps not adaptable to all conditions, as, indeed, none of the others are. The Whitworth quick return is perhaps more "ingenious," and has the decided advantage of requiring no difficult or unfamiliar mechanical operations in its construction. The making of all the parts of it is tolerably simple and regular machine shop work. It is a rather difficult thing to make satisfactory eccentric gears, and I happen to know several good mechanics who would hesitate about undertaking it. There can be little doubt that the difficulty of satisfactory construction has discouraged the employment of these gears. Where eccentric gears have been employed for shaper movements it is probable that the designers, having only in view the making the return stroke as quick as possible, have adopted too great an eccentricity. The best results are to be had with little if any more difference in radii than shown in my diagram herewith.

As the gears for the throw shown in the diagram are only slightly elliptical, very satisfactory gears may be cast, and a suggestion is offered as to the way to make the pattern. It is well to have a tolerably coarse pitch, and, by the way, always have an odd number of teeth, with the center of a tooth and of the opposite space upon the central line of the gear. To make the pattern, just turn up a steel ring and cut it with the proper teeth and press it together upon opposite sides until the desired elliptical proportions are secured, then build in the center of the pattern of wood and cast your gears. There is all that is needed to make a good patent, and in conjunction with a friend, who is also a valued contributor to the "American Machinist," I hereby file our joint claim to the invention. It may possibly embody the one lacking link in the construction and use of eccentric gears.

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A New Surface Gage.

We illustrate a kind of an acrobatic surface gage lately brought out by Gardiner

A NEW SURFACE GAGE.

Bros., Danielson, Conn. The half tone shows its principal features. The joint in the base allows the post to be set at any desired angle from vertical to horizontal, the thumbscrew fastening it securely. The clamping screw with the small cross wire in its head clamps the pointer in any position, and by the same movement fastens the holder to the post. This device is sufficiently familiar to most of our readers. But after the pointer is securely fastened in position, it may be minutely adjusted for hight by the little wire seen pointing downward from the middle of the holder. The large washer upon which the body of the pointer bears is double, the outer washer having a semicircular cross groove

in which the pointer beds. The inner washer has a small radial slot extending inward from the edge. The little wire spoken of turns a small horizontal spindle which has an eccentric pin projecting from the end of it, which works in the slot of the large washer. Turning this cross spindle one way or the other thus also turns the large inner washer, the outer washer and the pointer which it carries. The leverage gives the required minuteness of movement for very accurate adjustment of the point. The two inclined strips seen at the right hand end of the base have their faces milled so that the gage may be applied to the edge of a planer platen or any similar place.

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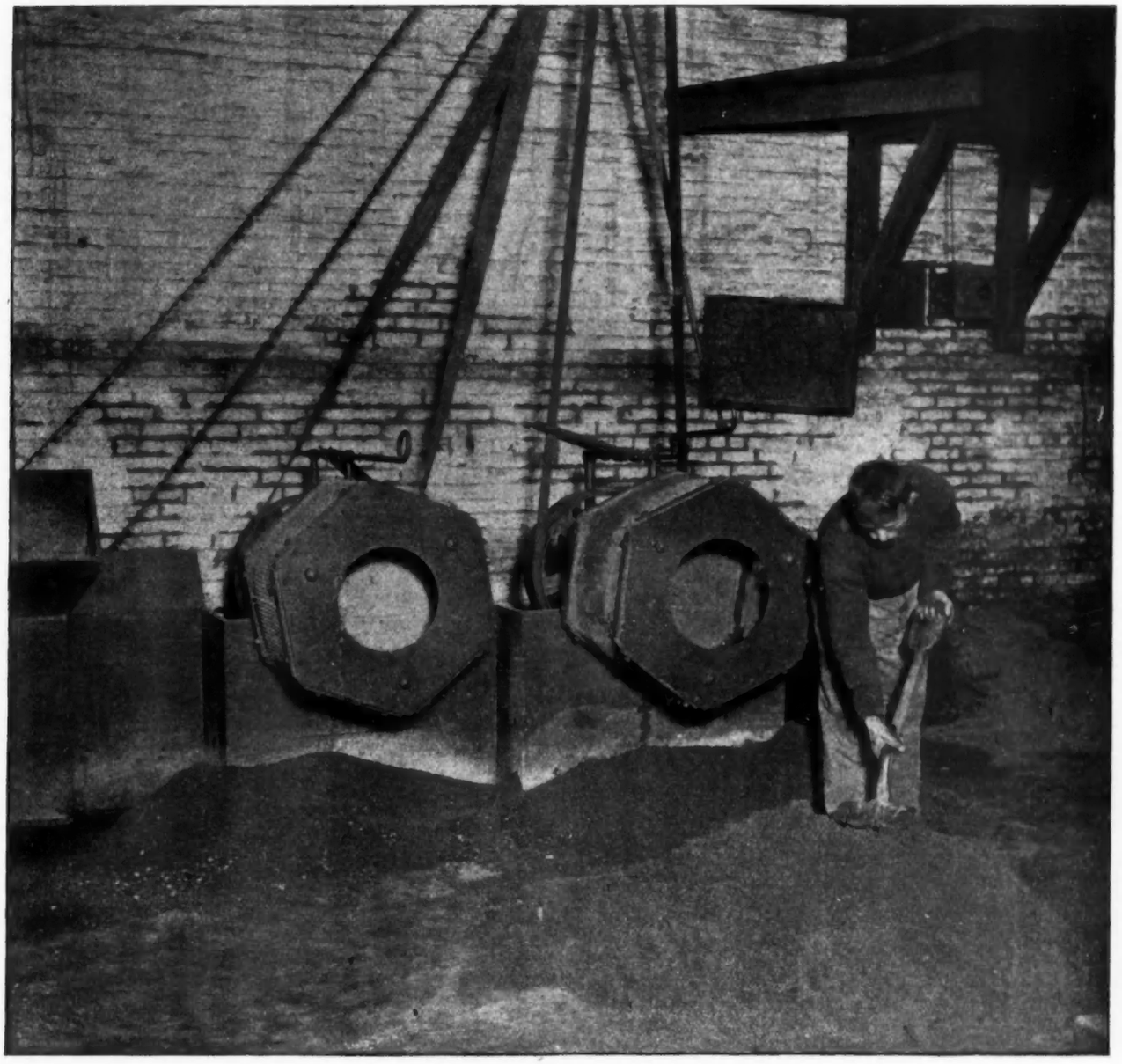
Up-to-Date Sand Sifting and Mixing.

The half-tone herewith shows a foundry interior and a familiar foundry operation in progress, but with apparatus and under conditions not so familiar. Sifting sand by hand is a tedious and back-breaking operation and it is unaccountable that it has prevailed so long. Various reciprocating sifters have been devised of late years, but they have always been more or less objectionable and inconvenient. The sifters here shown seem to be of such a common sense type that we are tempted to wonder why they have not been devised and in use long ago. Two sifters are shown and the construction of them is self-evident. A horizontal shaft is mounted on a couple of standards with tight and loose pulleys between, and the sifter on the outer end of the shaft. The sifter consists of a hexagonal frame about 30 inches diameter and 18 inches deep horizontally, the periphery consisting of wire netting of suitable mesh. The sand is shoveled in through the opening in the face. Ribs in the inside serve to lift and stir the sand as the sieve revolves.

The two sieves here shown are arranged to sift coarse and fine respectively. The netting on the left hand sieve is ½ inch mesh and that on the right hand is ¼ inch. The finer sieve is used as a dry sifter and mixer, and the coarser one as a mixer after the material is wet down. After the sifting and mixing is all completed the sand is conveyed automatically to the upper floors by the conveyor at the left. In this case a 250 volt dynamo of one horse-power drives the two sieves and the conveyor. The sifters are made by Gould & Eberhardt, Newark, N. J.



REVOLVING SAND SIFTERS.

▲ ▲ ▲

It seems that our clothes and things do not wear out, or at least do not grow old, fast enough, and a patent has just been issued for an apparatus for "aging" fabrics.

The Spencer Double-Turret Automatic Screw Machine.

Few mechanics are better known throughout the world than the inventor of the Spencer rifle; the weapon which was referred to by the Confederate prisoner when he said he wanted to "see that gun that you load up on Sunday and then shoot it all the rest of the week." Mr. Spencer's fame as an inventor does not rest solely upon his improvement in implements of war, however. As inventor of the first, and for years the only extensively used automatic screw machine (the "Hartford"), his influence upon the development of American manufactures has been important and far reaching. Our readers will no doubt be interested in this description of his latest creation—an automatic screw machine which embodies some radical departures from previous constructions, and makes screws and other pieces involving operations on both ends; the "second-end" operations not interfering with the other in any way, but both going on simultaneously; the arrangement of the mechanism being such that the work is uncommonly accurate and true.

The writer, during a recent visit to the factory of the Spencer Automatic Machine Screw Co., at Windsor, Conn., saw some of these machines at work making bicycle nipples complete from the rod, including forming, drilling, tapping, flatting for wrench and slotting, without any attention whatever. It is true that all these operations are performed automatically by special nipple making machines, but these are fit for nothing else, while the new Spencer double turret machine is a universal screw machine, and can be readily fitted with tools and set up for any job of screw making or other work within its capacity.

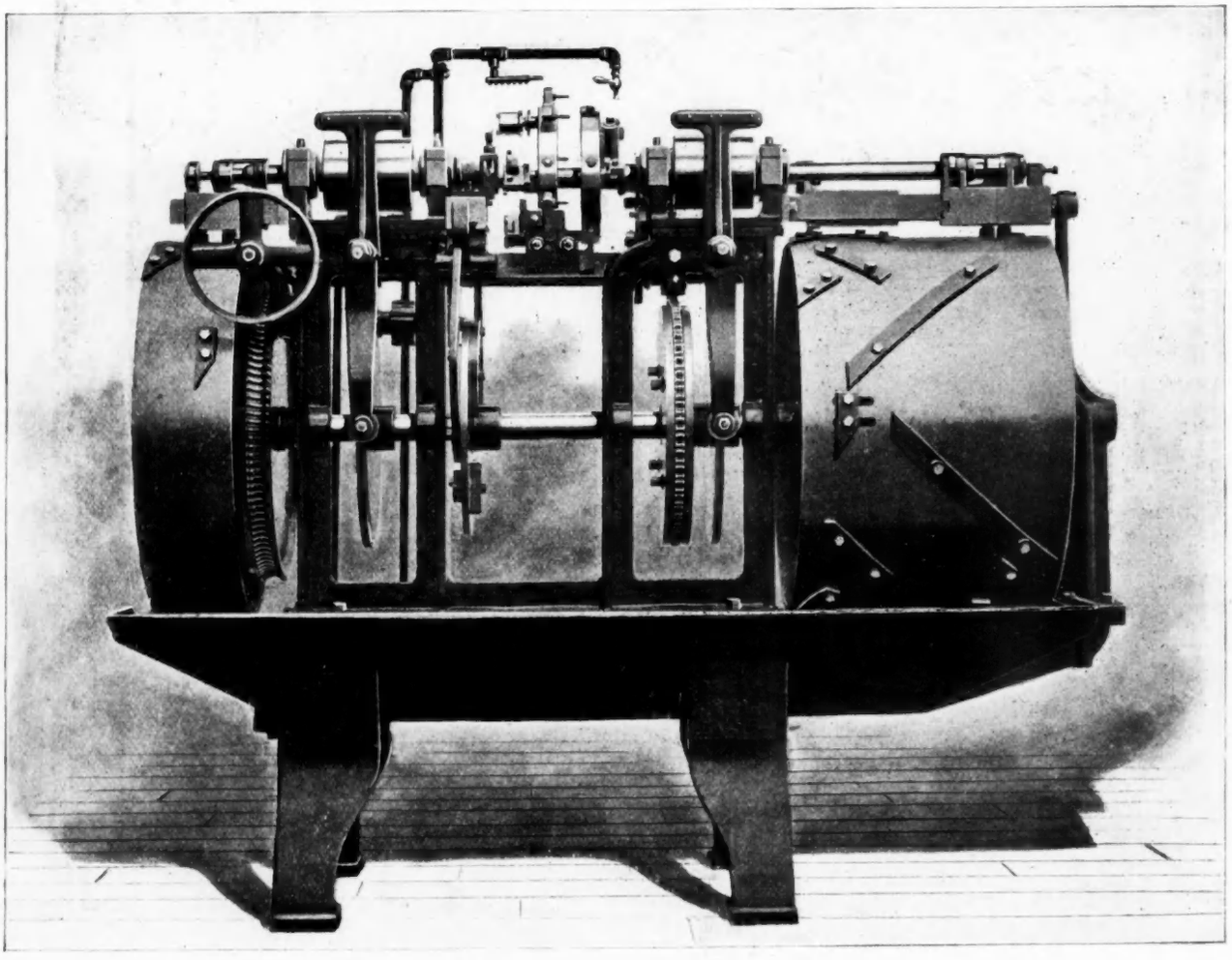


Fig. 1. FRONT VIEW OF SPENCER DOUBLE-TURRET AUTOMATIC SCREW MACHINE.

At Figs. 1 and 2 we give front and rear views respectively of the machine. Mr. Spencer, like many other inventors, makes no drawings, he sketches: sometimes with a pencil and sometimes in the air with his finger, and we are indebted to the Sigourney Tool Company, for some blue prints made by them and used in their shops in Hartford, where the machines are built for the Spencer company. These prints are such mere outlines as are essential in construction, but from them we have selected some views which will assist in understanding the machine.

Referring to Figs. 1 and 2, we see that the machine bears some general resemblance to its predecessor, but there are two spindles instead of one, and there are also two turrets which, instead of revolving in a horizontal plane as usual, revolve in vertical planes, and are supported upon a shaft lying at the rear of and parallel to the spindles. This shaft is double; i. e., there is one shaft within the other, as shown at Fig. 3. This shaft has a constant tendency to rotate toward the front of the machine; the impulse being given it by the sproket chain seen most clearly in Fig. 2. This chain is driven by a large wheel, or rather ring, having a few projecting pins upon it, this ring being placed between two disks which are keyed to the cam-shaft below. On each side of the ring is a leather disk, and by tightening up the screws provided for the purpose, any desired frictional turning moment is imparted to the ring, and thus whenever the turrets are released they rotate and are prevented from doing so only by the tool stops, one of which is fixed in the periphery of the forward turret for each tool (six in all), and when any tool is in action its stop rests upon and slides over a hardened steel rest, as seen in Fig. 1 and, in outline, at Fig. 4. All

these surfaces are of steel, hardened and ground, and, as will be noticed, the position of the turret is determined by a stop or index, which is always as near the tool as it is possible to get it, and great accuracy is thereby secured.

The turrets revolve together and are both controlled by the same stops, by reason of the fact that the two substantial steel pins seen in Figs. 2 and 3 are threaded into the rear turret and the forward turret slides freely upon them.

Only the forward turret has an endwise motion for feeding, and this motion is imparted by the grooved collar at the extreme right of Fig. 3, which is fast to the inner shaft, to which the forward turret is also fast by a pin as shown. This feed motion is derived from cams set on the left hand portion of the cylinder at the right of the machine in Fig. 1, also seen at the left of Fig. 2.

The rear turret has no endwise motion, but the feed motion for operations performed by it is effected by moving the secondary spindle endwise in its bearings; motion for this being derived from cams set on the right hand portion of the same cylinder. Two sliding blocks are seen at the extreme right of Fig. 1. One of these opens and closes the chuck which holds the work, and for that purpose is moved independently of the other, and both are moved together by the cams when it is desired to give the spindle endwise motion for feeding or transferring work from the primary to the secondary spindle.

The four-armed pulley seen at the left of Fig. 1 is on a cross shaft which carries the worm for driving the cam-shaft below. This worm shaft passes through to the rear of the machine, and at its other extremity carries a bevel pinion which drives the longitudinal shaft seen below the turrets in Fig. 2. From this last named shaft the oil pump is driven by spur gears as shown, and further on to the left is a train of spur and bevel gears also connected to this shaft, by means of which a small arbor fixed in a bracket attached to the rear turret is driven; this arbor carrying the saw by which screw heads are slotted, or a drill for cross-drilling the work when desired.

The operation of the machine is substantially as follows: The rod or bar of stock enters at the left of Fig. 1, is fed forward through the primary spindle and tightened in the chuck automatically in the usual manner. The tools in the forward turret then operate upon it one after the other, the backward motion of the turret allowing the stop to slip off the rest so that the turret revolves freely to the next stop; which engages the rest in its turn by reason of the fact that the turret has by that time been again advanced. The cut-off tool is operated in the usual way. When this end of the piece has been completed, and before the cut-off tool is brought up, the secondary spindle is projected forward through its bearings, passing through the gaps shown in the turrets at Fig. 5, which are made for that purpose. The chuck in the secondary spindle is at this time open and both spindles are running at the same speed. When the chuck of the secondary spindle has been passed over the work still revolving in the primary spindle, it is closed upon the work and both spindles and the work then all revolve together while the cut-off tool separates the work from the rod; after which the secondary spindle is drawn back to its place and, while the front turret is performing its operations upon a new piece, the rear turret is finishing the pre-

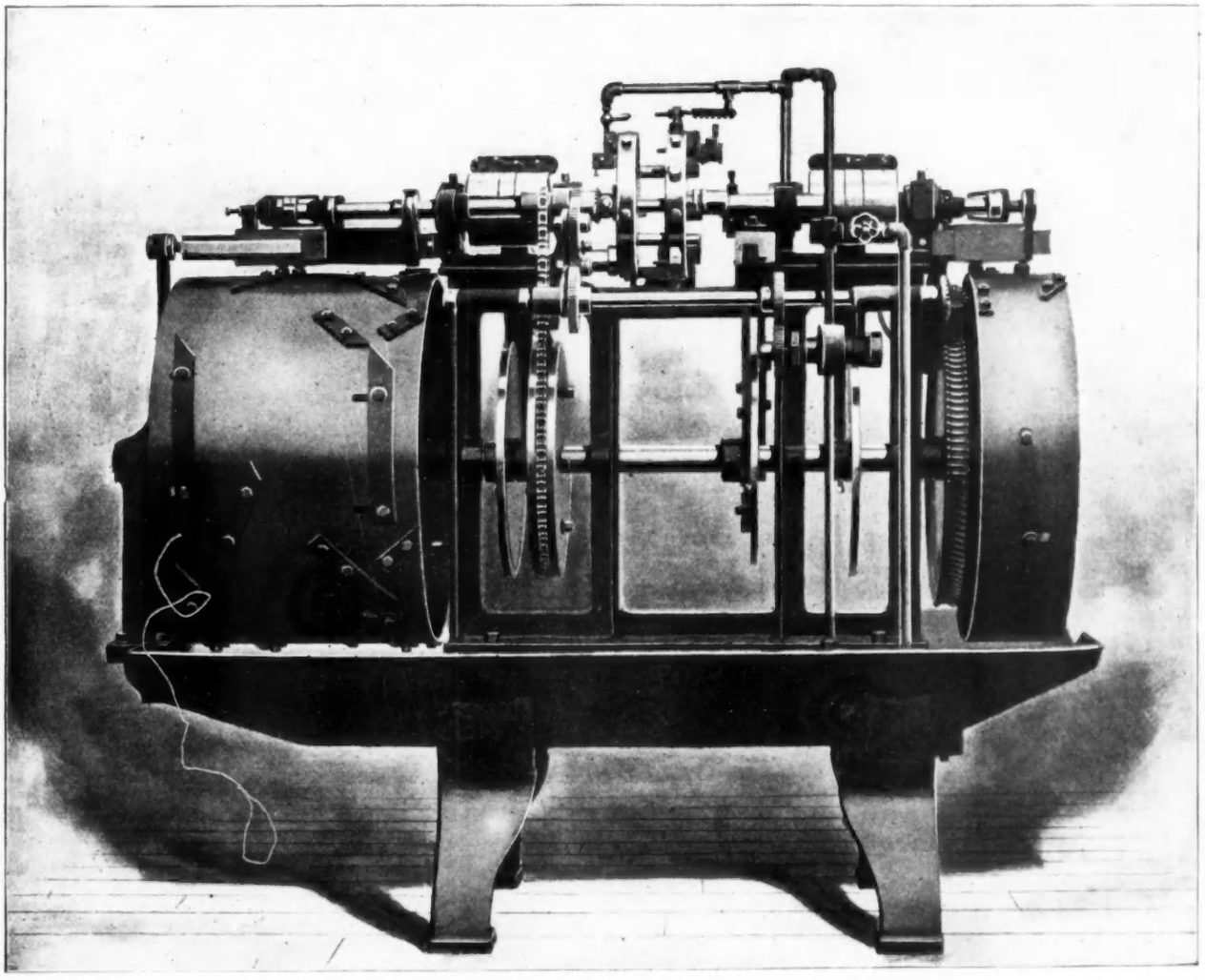


Fig. 2. REAR VIEW OF SCREW MACHINE.

ceding piece; the operations being, of course, simultaneous.

When the work is of such simple character that all the tools are not needed, corresponding stops are left out, and the turret loses no time by intermediate stopping. An automatic ejector fixed in the secondary spindle throws the finished work out and drops it into a convenient receptacle, separate from chips and oil.

The two long cam strips seen on the cylinder at the right of Fig. 1, move the secondary spindle forward to receive the work and back again. This cam cylinder rotates towards the observer. Just below the lower one of the two long strips is seen a short cam, which, passing between the two rollers on the sliding blocks above, does not move the one at the right, but moves the other one towards the left, and thus opens the chuck, allowing the finished work to be ejected. Then the long cam strap shoves the spindle forward, where it dwells for a moment, and the short cam seen on a level with the shaft then closes the chuck. Both rolls and slides then remain still until the upper long cam strip comes into contact with the left-hand roll and shoves both sliding blocks back to the position shown, thus retracting the spindle. One of these two sliding blocks is made to shove the other along as may be required.

When a bicycle nipple is to be made, requiring to be flatted for a wrench at one end and slotted for a screw-driver at the other, the flatting is done by a tool somewhat resembling a broach, which is forced over the work between a rough and a finishing cut and while the work is stopped from revolving.

Such pieces as bicycle pedal cones, requiring operations from each side true with others, are made upon this machine, and among the interesting specimens of its work in possession of the writer is the one shown herewith, composed of four separate pieces to go together as shown; all these pieces being made from the brass rod automatically, i. e., they are formed, threaded, drilled, tapped, slotted and dropped from the machine, finished as shown, without any attention whatever except to keep the machine supplied with stock and the tools in good working order. Two sizes of the machine are at present built; the No. 1 taking ⅜ stock, and the No. 2 ¾ stock, the length of cut in each being 1¾ inches. A No. 3 machine taking 1 9-16 stock is in process of construction, and will be ready for the market during the present season.

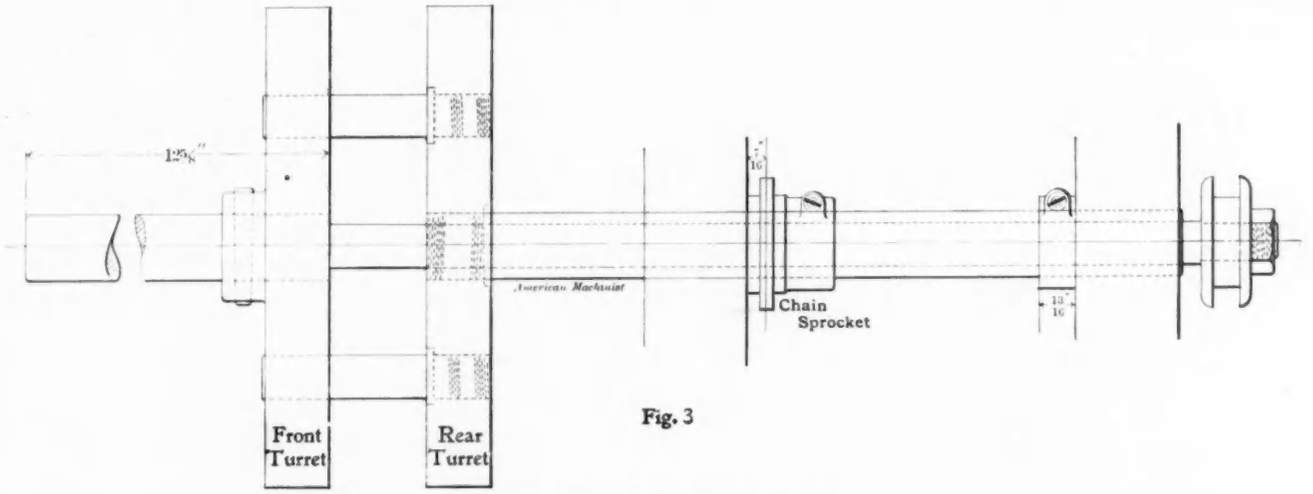


Fig. 3

TURRETS AND SUPPORTING SHAFTS.

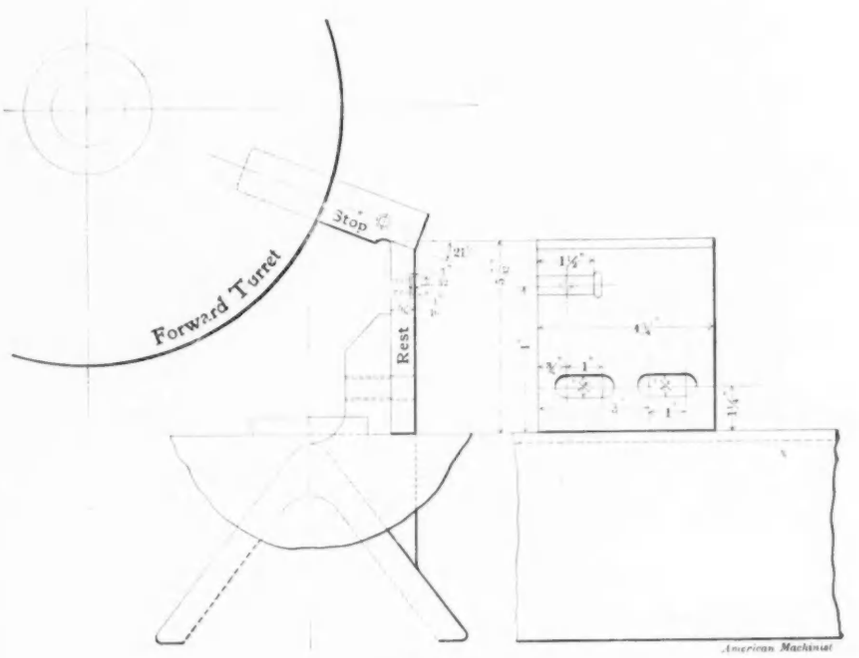


Fig. 4

SHOWING POSITION OF REST AND TOOL TURRET STOPS.

Charity at Its Best.

"There is an interesting incident connected with the building of the gunboats 'Wilmington,' 'Helena' and 'Nashville' at Norfolk, which aptly serves to illustrate the character of the founder of the shipbuilding industry here, Mr. C. P. Huntington. It was during the panic of 1893, when general business depression was felt throughout the country, that these vessels were contracted for. The shipyard had practically closed down because there was no work, and hundreds of men were out of employment, with families suffering for the necessities of life. Mr. Huntington instructed the superintendent of the industry to bid for the construction of the three gunboats—'Wilmington,' 'Helena' and 'Nashville'—which Congress provided should be added to the Navy. 'Make your estimate,' said Mr. Huntington to the superintendent, 'and then make the bid $50,000 less than the actual cost of construction.' When asked why he did it, the magnate replied: 'I did that much for humanity's sake. Those men had to have employment, and I could afford to lose $50,000.' The contract was awarded to Mr. Huntington's company, the bid being $300,000 under the lowest of the others

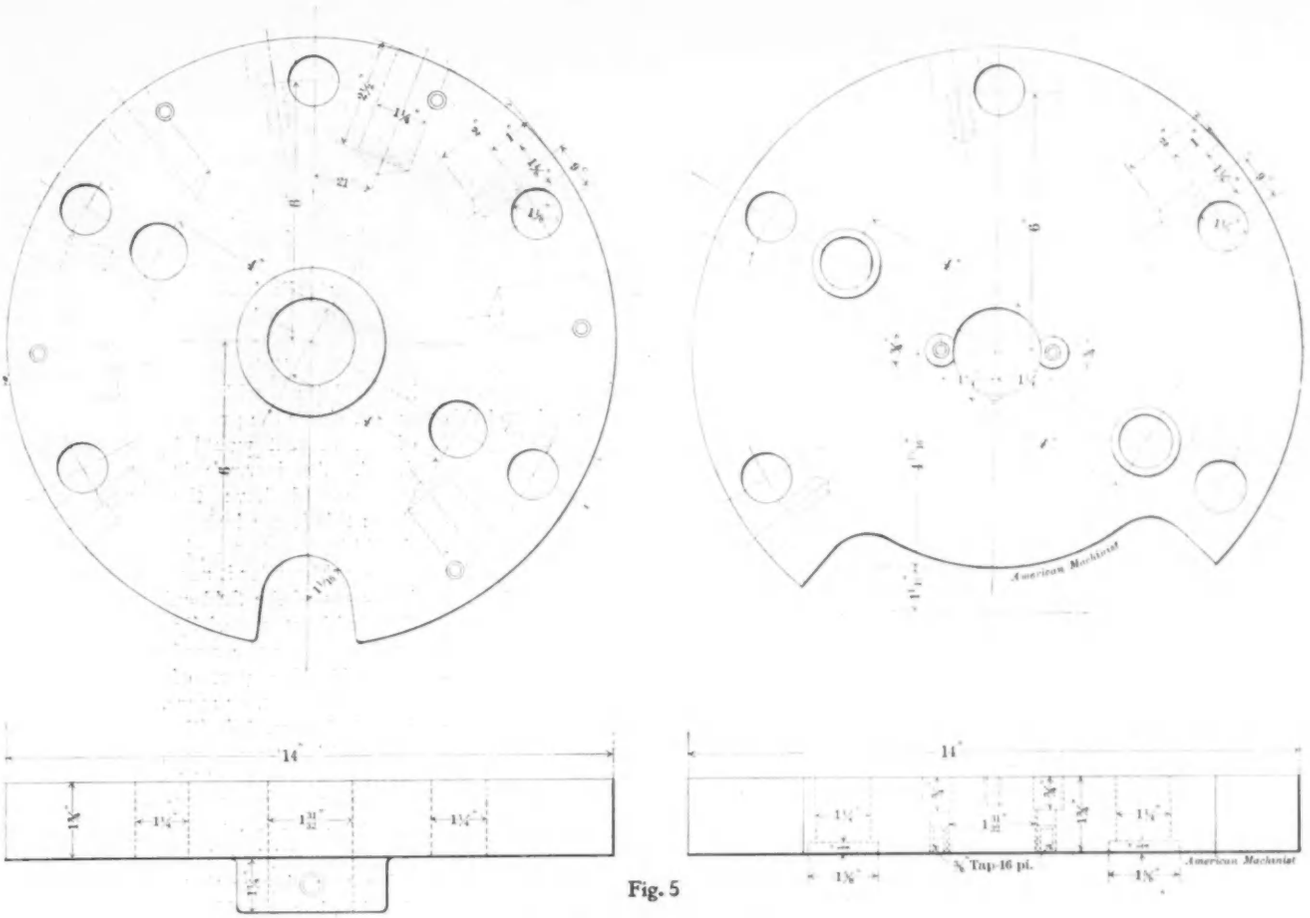


Fig. 5

FRONT AND REAR TURRETS.

offered. It was a magnanimous act, and in a few weeks a thousand or more men were given employment and many hearts made glad. It is now thought that the company will not lose anything on the vessels, and the premiums they earned on their trials will about cover the deficit, but Mr. Huntington did not know this when he contracted to do the work."—"The Landmark," Norfolk.

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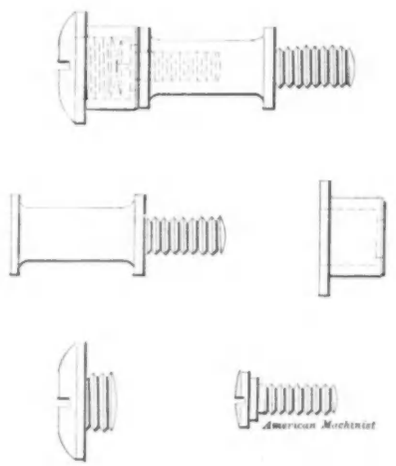
Repairs of Electrical Machinery—Field Coils—I.

BY A. R. HARRIS.

The field coils of electrical machines, under all ordinary conditions, give very little trouble, especially if they are series-wound; but, like all things human, they are liable to fail. It is therefore well to know how to remedy defects, and particularly to know what temporary expedients may be resorted to so as to continue using the apparatus until suitable repairs can be made. It frequently happens that a machine that gives out is located at some place far distant from shops where electrical repairs are made, and the time lost in sending the damaged part to the distant shop, and having it returned, may be of much greater value than the entire cost of the apparatus. In many instances, on this account alone, duplicates



SAMPLES OF THE WORK OF THE SPENCER AUTOMATIC SCREW MACHINE.

of the parts that are most liable to give out are kept on hand, and it is not uncommon to have two sets of machinery, so that one may be set in operation as soon as the other breaks down. In view of these facts, it is proposed in these articles to explain the various ways in which damaged field coils may be repaired temporarily, as well as permanently, so that either course can be followed, according to the exigencies of the occasion.

Field coils are wound either in series with the armature, or in shunt relation thereto, and in what are known as compound-wound machines there are two separate coils, one being in series, and the other in shunt relation with the armature. Thus it will be noticed that there are three different types of winding, the one used being dependent upon the character of the machine. Arc light dynamos are wound with the field coils in series with the armature, and on that account the wire is large and the number of turns very few. Incandescent light dynamos are wound with the field coils in shunt relation to the armature, and on that account the wire is very small, and the number of turns very great. Railroad motors, and in fact all motors that are not required to run at a constant speed, are wound in series, just the same as an arc light dynamo; but motors used to drive machinery at a constant velocity are shunt-wound, just the same as incandescent light dynamos. An incandescent light dynamo, if of large capacity, will have, in addition to the shunt coils, series coils consisting of a few turns of wire, the object of this being to render the regulation of the machine more perfect—that is, to enable it to maintain a more uniform pressure of current, so that the lights may burn as brilliantly when the full number are in operation as when there are only

a few. Very large motors used to drive machinery are also made with series and shunt field coils, the object being to secure closer regulation of the speed, so that the velocity may remain practically the same, whether the full load is on, or only a small fraction thereof.

As may be inferred from the preceding, the various styles of winding are used for specific purposes, to accomplish definite results; hence, if the coils become damaged in any way, it is necessary that the injury be repaired in such a manner as to not produce any change, in the coils, of such a character that it would interfere with their performing their normal functions. It might appear at first sight that, to accomplish this result it would be necessary to not disturb the windings in any way, but, as will be shown further on, this is not strictly true. Changes may be made, provided they are of such a nature that they will not affect the electrical action of the coils, and sometimes, by making such changes, the work of patching up a burned-out field coil can be greatly simplified, but no one can undertake to follow such a course unless he understands the manner in which the coils act. We will therefore explain, briefly, their functions, and will then show how in certain cases this knowledge can be turned to good account. We will not undertake to point out all the cases that are likely to occur in practice, in which such knowledge will prove beneficial, but enough to indicate what they are likely to be, and the general course of procedure that will prove the most advantageous under the particular conditions.

Generators that are used to operate incandescent lights, or to furnish current to drive motors, unless very small, are provided with a compound winding, as previously stated. Motors for stationary purposes, if small, are made with a simple shunt winding; but if very large, are also compound-wound, although not universally so. A compound-wound motor is said to be differentially-wound, for reasons that will be explained presently. The generators are required to deliver a current of a given pressure, from which a deviation of only a small fraction, generally two or three per cent., is permissible, no matter what the variation in the strength of the current may be. The motors are required to run at practically the same velocity, regardless of whether they are developing all their power or only a small portion thereof. The use of shunt coils accomplishes this result nearly, but not perfectly, and it is on this account that the series coils are added. The reason why the shunt coils nearly accomplish the result is, that as the pressure of the current remains constant, the amount of current that passes through the coils is always the same; hence, the magnetism of the field remains the same, and so long as the field strength remains unchanged, the pressure developed by the armature will be the same at the same speed. If the steam engine governs well, the generator will develop a nearly constant pressure. If the pressure of the current remains the same, the motor will run at nearly constant speed. These statements would be absolutely true, if the wire wound on the armature of the generator or the motor had no resistance, but, practically, this condition cannot be realized. The resistance can be reduced to a very low point, by making the wire as large as possible, but it cannot be entirely removed. Now, to overcome the resistance of the armature wire, a certain portion of the pressure of the current must be used, and this will increase in amount as the strength of the current through the armature increases; therefore, the actual result will be that as the load on the machine increases, the net pressure will decrease, but the decrease will be small. The series coils are provided to make up for this loss of pressure, and if they are properly proportioned they will compensate exactly, so that at all loads the pressure will remain the same.

In the case of a motor, the series coils must be connected so that the current passing through them works against that passing through the shunt coils. The reason for this is, that as the current in the armature increases, the portion of the pressure absorbed in overcoming the resistance of the wire increases, and therefore there is less left for the back pressure to balance; hence, a less number of revolutions is required to balance it. Now, if the strength of the field is reduced so that the back pressure developed per revolution is less, a greater speed will become necessary to enable the back pressure to rise to the required point; therefore, the current in the series coils is reversed so as to weaken the field. For more detailed information on this subject, the reader is referred to previous articles that have appeared in these columns.

If a generator is not required to develop a constant pressure, it is not necessary to magnetize the field to a constant strength at all times; therefore, a shunt coil is not needed, and is not used, owing to the fact that deviation from a constant pressure could only be made limited with it, and further, because even in cases where a small deviation from constancy would answer the requirements, the greater liability of the shunt coils to get out of order renders advisable the use of series coils wherever possible. These statements are equally true of motors that are not to run at a constant velocity.

The magnetic force of the field magnets of a motor or generator is dependent upon the strength of the electric current that passes around them, multiplied by the number of turns of wire in the coils. From this it can be seen that the effect of a small current can be made as great as that of a strong one, providing the former passes around the coil a greater number of times. As an illustration, if a current of ten amperes passes through a coil having two hundred turns, it will develop the same magnetic strength in the field magnets as a current of one ampere passing through a coil consisting of two thousand turns. If the coils of a series-wound machine have, say, two hundred turns, it would make but a slight difference in the action of the machine if they were replaced by other coils having one hundred and seventy or two hundred and thirty turns. The actual effect would be, that in the former case, if the machine were a motor, it would run a trifle faster, and if a generator, either the pressure or the strength of the current would be somewhat reduced. An increase in the number of turns would have the opposite effect. From this it can be seen that if anything should happen to a series-wound machine that would render it necessary to cut off a few turns of the field coils, this could be done without materially affecting its operation, unless the number of turns were a considerable part of the whole, say twenty per cent. or more. Owing to this fact, if it would facilitate doctoring up the machine temporarily, to follow such a course, there would be nothing objectionable in doing it. It cannot be said just how much wire could be removed without modifying the action of the machine to a degree that would be objectionable, because this would depend upon the intensity to which the field is magnetized with the full amount of wire, and this is not the same for all makes of machines, or anywhere near the same; but knowing that some wire can be removed without effecting a serious change, no one would hesitate to remove all that was actually necessary and then ascertain by the running of the machine whether the change in the current was more than could be tolerated or not. If more, then the only course to pursue would be to add a few more turns, until the current was increased to a point that would answer the requirements. In winding on these extra turns, it would make no difference whether they were laid close together or not, or whether they were tight down on the remaining portion of the injured coil; all that would have to be looked after would be the perfect insulation of each turn from every other turn and from the frame of the machine.

If the machine is magnetized by more than one coil, the number of turns that can be removed from either coil will in all probability be less than would be permitted by the variation in the current. In a case of this kind the effect of removing turns from one coil would not be confined to affecting the strength of the current, but also to causing an increase in the sparking at the commutator, and this might become serious long before the reduction in current would reach an objectionable point. To get around this difficulty, the proper thing to do would be to

add a few turns to the damaged coil, if it can be done conveniently. If there is any difficulty in doing this, the next best thing is to cut out a few turns on a coil that is wound on a pole of opposite polarity, or which affects poles of opposite polarity. Wire can be cut out on one of these coils without actually removing it, by simply scraping off the insulation on one of the turns upon the outer layer, and soldering a wire to it, and then connecting this to the end of the coil. If this connection is made at a point where it cannot be seen, it can be removed when the final repairs are made, and the coil will not be defaced. If by cutting out all the outer layer, the sparking is not reduced to a harmless point, it will be advisable to make an extra effort to add turns to the damaged coil, as it would be necessary to remove the outer layer of the perfect coil to cut out additional wire, and this would involve doing more work when the permanent repairs are made.

The foregoing course of procedure can only be followed when the injury to the coil is confined to a certain part of it, as would be the case if it should receive a blow from some falling object; it very often happens, however, that the coil is destroyed by being overheated by an excessive current, and when this occurs, the whole coil must be removed, as the insulation will become charred, and therefore useless. In such a case, the only thing that can be done is to rewind the coil, and this is a very simple operation. All that is necessary is to wind the wire in the same direction that it was originally, and to put on the same number of turns; for although, as has been stated in the foregoing, a change in the number of turns will not make a very great difference in the action of the machine, it will make some difference, and when a permanent repair is made, it should be of such a character as to render the machine as perfect as it was before the damage. The size of the wire used can be larger than that originally on the coil, but not smaller. It would really be advisable to use larger wire if there is room for the proper number of turns, of the larger size, but not otherwise. The larger wire would be able to carry more current, and therefore would be less liable to burn out by an overload in the future. If a coil is rewound, the work should be done in a room that is free from metal filings, or chips, as should any of these stick to the wire and be carried with it into the coil the result would be that in a short time the points of the metallic particle would work their way through the insulation of two neighboring wires, and establish a short circuit which would destroy the coil. If care is observed in this direction, and all the metal surface upon which the cell is wound is well covered with insulating material, so as to prevent the wire from coming in contact with it, the work will be as substantial as the original and will give perfect satisfaction.

Letters from Practical Men.

Safety Valve Practice.

Editor American Machinist:

The paper under the above heading, by Mr. Hemenway, in March 11th issue, having attracted my notice, I wish to point out some things which I consider to be errors, and also what I consider a correct method of calculation:

The paper gives some "authority" who gives "pounds of water evaporated per hour multiplied by .0055, which gives the nominal area of the valve in square inches, and this for all reasonable pressures." Without going further into it at this instant, it would seem that the last clause is sufficient to condemn it, as it is the volume of steam which has to be considered, not the weight.

At the end Mr. Hemenway's good judgment and observation of valves as they are, gave him two 3-inch valves for 25 square feet grate surface burning 17 pounds coal per hour on each square foot and evaporating for each pound of coal 9 pounds of water and $25 \times 17 \times 9 = 3825$ pounds evaporation per hour instead of the rule above.

Two valves having 3 inch diameter of bore have 14 square inches area, which is something greater than the steamboat inspectors' rule for the lever and weight valves, which requires "1 square inch of valve for 2 square feet of grate surface," and for "spring loaded valves which give an increased lift by the operation of steam, after being raised from their seats (pop valves) 1 square inch to 3 square feet of grate surface."

There is nothing said in the above rule about the amount of the lift, but the apparent assumption that the pop valve has a greater actual discharge area than the lever and weight valve is untrue.

The following table shows the results of experiments and measurements and calculations made by me upon valves of commerce. The actual opening is (circumference of the bore multiplied by lift $\times .7$, which is the sine of 45°):

1	2	3	4	5
Diameter.	Area Nominal.	Lift.	Area Actual.	Ratio.
1	.7854	.04	.088	.113
1½	1.767	.07	.224	.128
2	3.141	.05	.220	.070
2½	4.909	.08	.440	.090
3	7.069	.08	.528	.075
3½	9.621	.08	.616	.064
4	12.57	.08	704	.056

The figures in column 5 are those in 4 divided by those in 2.

From the above table it can readily be seen how unsatisfactory any calculation is to find the nominal area, the ratio of the discharging area being so small and uncertain, we see the 1½-inch valve actually with a greater discharging capacity than the 2-inch, and we see the cramping effect further produced by the conical valve seats, which make the actual opening .7—for a 45° angle—of what it would be with a flat seat.

It is only in consequence of the great velocity which the steam has when it does find an opening, that safety valves do so so well as we find them. The best rule for this velocity—and easily remembered—was given to me verbally by Mr. Napier, who was a fine old experimenter in the University of Glasgow:

The velocity of steam issuing into the air with almost any pressure, 50 to 100, or 150 pounds behind it, is 10 miles per minute; this is a result of long and careful experiment.

Call 10 miles equal to 52,000 feet, and $\frac{52000}{144} = 360$ cubic feet per minute discharge through 1 square inch of actual opening.

Applying this rule to Mr Hemenway's two valves 3 inches diameter, each of which I assume to be equal to that shown in the table, I have $.528 \times 2 = 1.056$ square inches discharge area and $360 \times 1.056 = 380$ cubic feet per minute.

The evaporation is $\frac{3825}{60} = 63.75$ pounds per minute, now $\frac{63.75}{380} = .165$ pounds weight per cubic foot, which by the steam table corresponds to 68 total, or 53 pounds gage pressure, which will be the lowest pressure at which the valves will pass the steam away, and is a very good showing for Mr. Hemenway.

If the density of the steam be doubled we have $.165 \times 2 = .330$ pounds weight per cubic foot, which gives us a pressure of 150 total or 135 by gage and the valves will be blowing only half the time.

If flat seats are used with the valves, in place of the 45° bevels the area of grate surface which the valves will take care of will be increased by .43 and $25 \times 1.43 = 35.75$ square feet and $\frac{35.75}{14} = 2.55$ square feet for 1 square inch of nominal valve opening.

If the lift be increased from .08 to .12 the ratio comes up to 3.75 which is considerably in excess of the steamboat inspectors' rule, which rule appears to me very good except for their preposterous requirement of the use of the bevel seat.

I know of no harder duty for a safety valve than it gets on a locomotive, and thousands of flat seated valves have been used there for years giving the best satisfaction in every way.

The navy uses the rule 3 square feet grate surface to 1 square inch nominal, but they also require the valve to have a lift of ⅛ the diameter, which would make the actual area ⅓ but for the bevel seat which reduces it to .35; even this I con-

sider twice as great as it should be for any purpose.

When a pop safety valve has so great a lift ⅛ the diameter the great velocity of the steam in the bore of the valve causes the solid water to be lifted and discharged, and the impact of that solid water beneath the valve causes it to lift still higher, thus increasing the trouble. In the meantime if the generation of the steam is not reduced the pressure gains because no steam is being blown away; this crazy action only stops when the water level is lowered considerably in the boiler. It is not good to use the escape pipe as a surface blow.

I will now give a summary of my ideas, regarding safety valves.

There may be 2 square feet of grate surface for each 1 square inch nominal area for very low pressures and 3 square feet per 1 square inch for high pressures whether the valves be pop or weighted.

The valves should have flat seats.

For pop valves the springs should be of such a length that the lift shall be .04 for each 1 inch diameter of the bore. The actual discharge area is then circumference of bore multiplied by lift, and is always equal to area of bore multiplied by .16.

The following table shows the proportions of a few valves made to the above rule:

1	2	3	4	5
Diameter.	Area Nominal.	Lift.	Area Actual.	Ratio.
1	.7854	.04	.125	.16
1⅛	1.000	.045	.160	"
2	3.141	.08	.503	"
3	7.069	.12	1.13	"
4	12.57	.16	2.10	"

The important figures are in column 4, which should be compared with those in my previous table.

I will now try my valves:

The United States steamer "Minneapolis," on her trial trip, developed 21,000 I. H. P. for all engines having in use 1,456 square feet of grate surface, and

$\frac{21000}{1456} = 14.4$ H. P. per square foot. The round number of the Steam Bureau is 20 pounds weight of steam per H. P. per hour, the evaporation was then $14.4 \times 20 = 288$, and the rate of combustion $\frac{288}{8} = 36$ pounds per hour of coal.

The evaporation per minute was $\frac{288}{60} = 4.80$ pounds, the navy rule allows me to use 3 square feet of grate, and I have $4.80 \times 3 = 14.40$ pounds weight to be discharged through a valve with 1 square inch area of bore, and an actual area of .16, as shown in my table, the diameter of the bore being 1⅛ inches.

Now, $360 \times .16 = 57.60$ cubic feet per minute which this valve will discharge, and $\frac{14.40}{57.50} = .25$ pounds weight per cubic foot corresponding to 108 pounds total pressure, or 93 by gage, which is the lowest pressure at which this valve will discharge by constant blowing the water evaporated.

The valves in the ship were set to blow at 180 by gage or 195 total, and the weight of this steam is .416 pounds per cubic foot, and this valve will discharge by blowing .6 of the whole time, if set at 180, all the water evaporated.

WILLIAM H. HARRISON.

Braintree, Mass.

▲ ▲ ▲

Marks on Bar Steel.

Editor American Machinist:

Since reading "Steel Sparks," in the "American Machinist," March 25th, I have taken the trouble to get one of the cards of instruction to steel users, that "Sparks" tells about, and I find that instead of getting out of trouble, I have rather got into it. In my letter, three months or more ago, I suggested that if the steel maker and the steel user wanted to work together to accomplish the best results, it would be well if they didn't go along, each in absolute ignorance of what the other was doing, but rather that each should try to help the other to details of knowledge or practice that he must otherwise go without. It would seem that the user of the steel would not be quite so completely in the dark if he knew, at least, the percentage of carbon in the steel that he was using, and so it would be a good thing if the manufacturer would stamp the percentage of carbon on the bar.

Sparks says: "Yes, there is something in that; but while we are at it, we might as well do it right. Instead of stamping the carbon, it is better to stamp the 'temper,' which is made up of a determination of all the hardening elements in the steel, rather than confine the stamping to a mere statement of the amount of carbon. Our firm gives Mr. Fulton more than he asks for. We stamp every bar of our steel with a letter indicating the temper, and in connection with it we give you a card with a list of the tempers, and what each is to be used for."

I got one of the cards, and that's where my trouble begins. It is better that I should know the temper than the carbon, but the card does not seem to know the difference. It says "the best results with any steel are obtained by selecting that which is of suitable *carbon* for the particular purpose." "A medium temper will give good service generally, but not so good as when the *carbon or temper* is just right." Then we have a list of "tempers," distinguished by letters of the alphabet from A to P, not using all the letters, with the things that it is best to use each for.

Now, that arrangement is very good, and gives lots of satisfaction to the parties who use that most excellent steel; but it tells me absolutely nothing of steel as steel. It tells nothing of the *carbon or temper*. Unless I have some collateral sources of information, I know nothing as to whether A or K or P may have the highest carbon. I am sorry to say that it does not seem to lead very directly to, or show the road to, any very intelligent co-operation in the use of steel.

MORRIS FULTON.

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American Made Instruments of Precision.

Editor American Machinist:

I was considerably interested in your discussion of the capability of American workmen, which you printed in the "American Machinist" of March 4th and 25th. Your position is surely substantiated by the condition of affairs in nearly all trades. For instance, it has been usual for colleges to import a very large proportion of their scientific instruments, partly because instruments of sufficient precision in certain lines of small demand were, and still are, unobtainable from our own manufacturers, and partly because special instruments, or instruments for which there is but a limited market, can often be purchased for less money in foreign countries. As the market in this country has increased along certain lines, so that American manufacturers find it possible to supply a staple article for the same purposes that the special foreign articles were purchased, we find the American product, which is equal to, or even more satisfactory than, the foreign article, taking its place. This change has been particularly marked in the trade in standard electrical instruments. Here is a trade in which the staple American instruments are more perfect than those of foreign manufacture, while special instruments for calibration, etc., can be best obtained from abroad. The same thing is true of such instruments as steam-engine indicators, pressure gages, standards of dimension (which you mentioned), meters of various classes, etc. In whatever lines the market makes it profitable to manufacture in quantity, it is usual to find the instruments manufactured by home workmen, on home machinery, fully equal to, and often superior to, the foreign product, but the American manufacturers and American workmen give but little attention to the manufacture of fine special instruments.

DUGALD C. JACKSON.

University of Wisconsin.

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The Yerkes Telescope.

Editor American Machinist:

It seems to me only fair to Messrs. Warner & Swasey to state that the mounting of the Yerkes telescope was designed by them, and that they should have full credit for their very satisfactory work. It is quite true that, as Professor Webster

says, I "traveled all over Europe, visiting every telescope of large size" before deciding to recommend to Mr. Yerkes that Messrs. Warner & Swasey be given the contract for the equatorial mounting of the 40-inch telescope; but I did not make the designs of the mounting myself. After careful inspection of the instruments constructed by Grubb, Gautier, Repsold, and others, I am fully convinced that Messrs. Warner & Swasey build better equatorial mountings than are to be obtained elsewhere. I do not know that the workmanship is superior to that of foreign instrument makers, but the designs are certainly better adapted to the purposes of the astronomer.

Without desiring to enter further into the discussion, I cannot refrain from adding that, in my opinion, Mr. Brashear's optical work cannot be matched by that of any European optician.

GEORGE E. HALE,
Director Yerkes Observatory.

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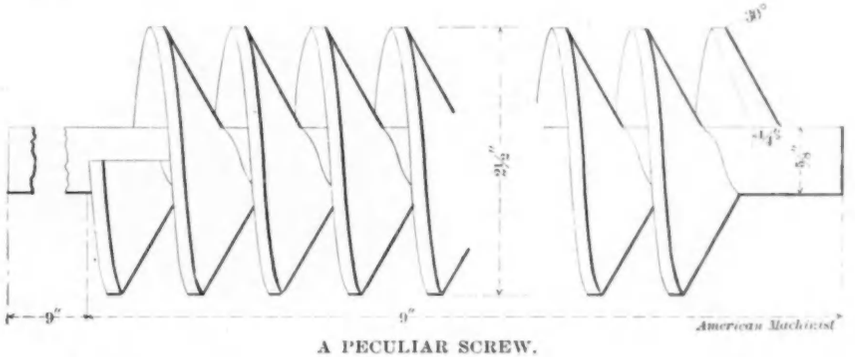
A Peculiar Screw.

Editor American Machinist:

I send you a sketch of a novelty in screw cutting, which I think will stand as a good representative in that line of work. The drawing will explain the feature fully. I wish to call attention to the length and diameter of stem and bottom of the thread, and the difference in thickness of base and apex of tooth. I cut it about ten years ago, just about the time I finished my apprenticeship. I made at the same time another one-half size and of like proportions for a Patent Office Model. I must say that I think that a more difficult screw to cut has not come to my notice.

R. SAFELY.

Buffalo, N. Y.



A PECULIAR SCREW.

An English Angle Gage.

Editor American Machinist:

Enclosed you will find some sketches of a tool I have found of great service in tool making, and assume that you may find room in your highly educational work for machinists in illustrating it for your readers. I originally made it to expedite the work of turning milling cutters for nut wrenches, but found it serviceable in the other cases as shown. In grinding drills I think it is the best tool I have ever handled, for by simply turning the gage or article to opposite sides, the slightest error is magnified twice, and as for making an hexagonal figure, no article could be better, for if the angles are made correct in the gage it will cause the sides of the figure to be of equal length.

London, Eng. KENO.

[We judge that the divisions shown in Fig. 2 are correctly spaced *horizontally*—not on the angle edge of the blade, as might be inferred.—Ed.]

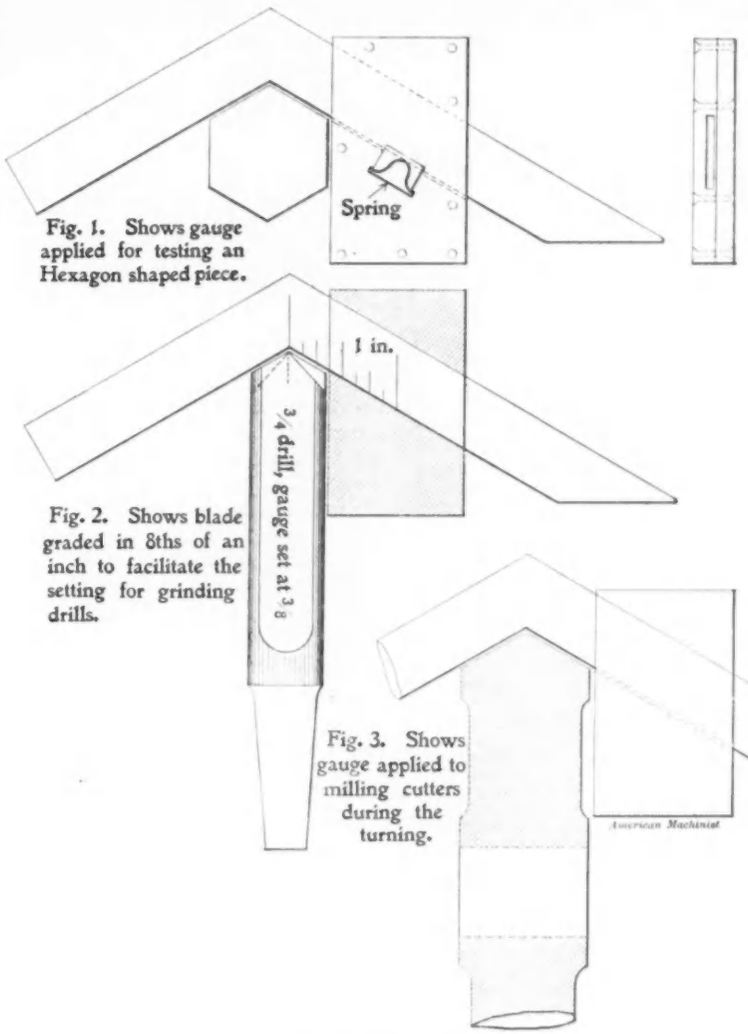


Fig. 1. Shows gauge applied for testing an Hexagon shaped piece.

Fig. 2. Shows blade graded in 8ths of an inch to facilitate the setting for grinding drills.

Fig. 3. Shows gauge applied to milling cutters during the turning.

AN ENGLISH ANGLE GAGE.

Allowance for Press Fits.

Editor American Machinist:

I have been rather expecting to see something more in your paper about allowance for force fits. Since none of your readers in the locomotive shops seem to take up the matter as they were asked to do in the issue of March 4th, I will inclose a table of force fits that is in use in one of the best shops in this city. The table pays no attention to the ratio of length and diameter, neither is the pressure given that would be required to force the shaft or pin into place:

TABLE OF FORCE FITS.

Diameters.	Minimum.	Maximum.
.00" to .49"	Dia. + .0005"	" " .001"
.50" to .99"	" " .001"	" " .002"
1.00" to 1.24"	" " .002"	" " .003"
1.25" to 1.49"	" " .002"	" " .003"
1.50" to 1.99"	" " .003"	" " .004"
2.00" to 2.49"	" " .004"	" " .005"
2.50" to 3.24"	" " .005"	" " .006"
3.25" to 3.99"	" " .006"	" " .007"
4.00" to 4.99"	" " .007"	" " .008"
5.00" to 5.99"	" " .008"	" " .009"
6.00" to 7.99"	" " .009"	" " .010"
8.00" to 9.99"	" " .010"	" " .011"
10.00" to 11.99"	" " .011"	" " .012"
12.00" and over	.001" X dia.	(.001" X dia.)+.001"

RICHARD P. JENKS.

Providence, R. I.

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The Location of Indicator Springs.

It has seemed to us for a long while that the standard indicator construction is fundamentally wrong in the location of the spring, which it seems to us would be much better placed if outside the cylinder and away from the influence of the heat. These springs are, of course, supposed to be adjusted to read correctly when hot, and figures are even given for the correction of the scale when the instrument is used on pumps or elsewhere where the temperature is normal. When it is said that the spring is adjusted to the correct scale when hot, a pertinent question is, how hot? The heat of the steam depends upon its pressure, and the temperature to which a spring indicating a high pressure steam cylinder is subjected is very different from that indicating a low-pressure cylinder. Moreover, the temperature of the steam varies during expansion, and is not the same during the return stroke as during the acting stroke.

These distinctions may seem to some to be somewhat fine-haired, but another use of the indicator is not subject to that criticism. We refer to its use on air compressors, especially with a view to determining the difference between the indicated powers of the air and steam cylinders. In the case of the air cylinder, the temperature to which the spring is subjected is entirely uncertain. With substantially the same air churning in and out of an indicator cylinder during different strokes, with this air warmed during compression and cooled during expansion, the average temperature to which the spring would be subject, supposing the cock to be left open indefinitely, would be about that due to half the receiver pressure. In point of fact, the cock is not usually left open long enough for the parts to acquire even this temperature, especially as the air does not heat up the indicator cylinder with anything like the promptness of steam. Even when the compression cylinder is boiling hot, the indicator cylinder seldom gets very warm. The quantity which it is desired to measure in this case is the difference between the two indicator cards, which, with machines of any size, seldom equals 10 per cent. of the area of the cards, so that a small error in the scale of the spring would entirely vitiate the conclusions which are the purpose of the work. Under these circumstances, we do not believe that data obtained of the frictional loss of compressors are of any value whatever, or that such data can be obtained from indicators as now made.

Back of all this, it is the first principle of experimental works to avoid errors rather than try to allow for them. Scaling the spring under heat becomes simply an attempt to allow for the effect of heat, when the instrument is used cold, whereas the placing of the spring outside the indicator cylinder would avoid these errors altogether, and it seems to us a clear case that the spring should be so placed.

▲ ▲ ▲

Saving Tools by Reducing Their Product.

It has always seemed to us an absurd thing that a housekeeper who is anxious to have everything as clean as possible, should still seek to have around her things that "will not show the dirt." To be simply consistent, it would seem that the things most of all to be desired would be those that would show the dirt most vividly. We are inclined to place in the same category as the housekeeper above, the manufacturer who is constantly on the lookout for the saving of his tools, and always kicking because they wear out and must be replaced.

We do not understand that a manufacturing establishment is primarily an asylum for the preservation of tools. If the shop is for turning out work, and if tools are for the doing of the work, and if they necessarily wear in the doing of it, then, within ascertainable limits, tool wear means work done; more rapid wear means quicker work; quicker work is cheaper work; labor cost saved at the expense of tool cost is very apt to be a bargain.

Some manufacturers see much farther in this direction than others. We have at hand a little practical lesson as to how these things work. There seems to be a tendency among the users of taps, for instance, to wear them out faster and to buy new ones more frequently than they used to do. Machine taps are made shorter. A ⅝-inch machine tap used to be 4 or 5 inches long in the thread. This is absurd on the face of it, when we think of the 1 inch or so of thread which a die has for cutting a bolt of the same size. But the long taps have held their own for many years. Their persistent use we may perhaps call not a time honored, but a time dishonored practice. We heard lately of a ⅝-inch tap with the thread only 2 inches long, which tapped 25,000 nuts before it was discarded. Now say that the short tap saved one-tenth of a minute over the old-fashioned long tap for each nut tapped. That would be 2,500 minutes or 41 hours. The short tap costs sixty cents; the long tap might cost ten cents more. The manufacturer with the long tap flatters himself that after the short tap is worn out he still has a tap left, at a cost of ten cents, that is capable of doing as much more work before it is worn out; so, to save this last ten cents worth of tap and make it available, he has already spent 41 hours of tapping time. We could not get Chinese labor as cheap as that would be, four hours for one cent, two and a half cents a day, seven dollars and a half a year. For the last half of the life of the long tap there would of course be expended another 41 hours of extra time, or 82 hours in all for its total active life. In the tap which lasts longer, and is therefore presumably cheaper, he has in fact a tap which, in comparison with the shorter tap, loses money for him upon every hole tapped, so that its longer life is an actual loss or a prolonged misfortune for him, and the sooner he is released from it the better.

Most proprietors do not, of course, sit down and reason or figure things out after any style analogous to that indicated above. The pity of it is that they neither reason nor figure at all, but simply kick upon general principles over a certain line of expenditure, when in fact all their profits must come as a result of expenditure, and no expenditure can be more profitable than for proper tools; not only in quality, but also in quantity.

Not only taps, but drills and files especially, and many other of the perishable tools of the shop may have their lives prolonged beyond a profitable limit by a system of nursing, which has too much

regard for their longevity rather than for their greater efficiency. In suggesting a little looking into this matter, we are not working in the interest of the tool maker or the supply agent, nearly as much as in that of the shop proprietor who is under the necessity of turning out the most and best work at the least cost.

▲ ▲ ▲

Anti-Rust.

Those who are troubled about the possibility of the rapid rusting away of some of the important members of our modern steel and iron structures, so that they may thereby be weakened and rendered more or less unsafe, might find much to reassure them if they would only visit the yards of some of our large dealers in second-hand building materials. They may find there plenty of columns and beams that have done long service in buildings, but they will not find very much iron rust. Every piece may have more or less rust about it, but any decided reduction of actual section or of practical strength will be hard to find, unless there is also found some evident local cause for it, such as a continual leakage and flow of water at some particular point.

Another reassuring exhibition is in the recent demolition of the Chicago post-office building. This has only stood twenty years, but, as far as its evidence goes, it offers little material for the alarmists. Even the corrugated lath was only slightly rusted from first contact with the mortar, and we may believe that in a hundred years it would have shown little, if any more, corrosion. The floor sheets showed no damage from rust; the beams and columns were all in excellent condition. Cement and mortar seem to be almost absolutely preservative of iron and steel from rust. Slight rusting of the surfaces is very likely to occur, and is harmless if the rusting is not continuous and penetrating, which it very seldom is, and never except from causes which may be avoided.

Of course, some mechanical common sense is necessary in the arrangement of the piping of buildings. If the main columns are used as conduits for leaky pipes, there is, of course, a source of danger; but the necessity of having the pipes always accessible and under inspection must of itself avert this danger, and no other seems to be in sight. Upon the whole, it would seem that the danger element due to iron rust in the modern building is almost entirely an imaginary one.

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Mechanical Influence.

"When the Army of the Cumberland was operating in Northeastern Tennessee, shortly before the battles of Lookout Mountain, Missionary Ridge and Chickamauga, I was a member of a detachment sent out on a certain occasion to help protect a chain of supplies several miles long. Communication was kept up mostly by means of army supply wagons, but over a small section of the route by a hastily laid railroad whose rolling stock consisted largely of two or three captured old-fashioned and inefficient locomotives, with a few box cars to match. All of these were constantly getting out of order, and with our force drawn largely from the country, and a meagre repairing outfit, it was utterly impossible to obtain from them anything more than the most unsatisfactory service. On one particular occasion one of the engines exhibited an instance of mechanical crankiness even out of the ordinary, and no one seemed to be able to discover the cause of the difficulty. In those days delays were certainly dangerous, and to cut a long story short, a call was made by our commanding officer for volunteers to aid either by suggestion or experiment in the remedying of the engine's fault. Out of the ranks of a Pennsylvania regiment stepped a young mechanic, who went to work with a will on 'the old crock' (in the locomotive sense), and was soon successful in putting it in working order again. His ability as an engineer was immediately recognized, and he was placed in charge of that engine for so long as our detachment should remain on that duty. But you should have seen the effects of this promotion upon the nature of the young man! Theretofore he had been a somewhat indifferent soldier, often displaying a mild contempt for good discipline, and sometimes even for the cause that had drafted him unwillingly from an apprenticeship in a machine shop in the Alleghanies. Now that he was taken from the dull routine of military life, and placed in a position where the strict performance of his duties was of great importance to the whole army, he evidently began to think himself an integral part of the campaign, and even injected an enthusiasm into his work that surprised his comrades of the ranks. No night was too dark, and no hours too long for this fellow, and he became, from the moment a premium was placed upon his duties, a new type of soldier. And this influence was more than temporary, for after our company was called back to regular service he kept up the lately acquired spirit, greatly distinguished himself for bravery at the Battle Among the Clouds, and was killed in a desperate charge on the field of Chickamauga."—"Cycling Life."

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Sketches for Articles Intended for This Paper.

We wish to call the attention of our contributors to the use of cross-section or similarly ruled paper for use in making sketches. Sketches made on this paper can be made square more easily than they can be made out of square on unruled paper, and thereby greatly facilitate the making of engravings. Many of the free-hand sketches received by us have to be redrawn because they are not square. Nicety in these sketches is not essential, but that they should be square is essential, and our contributors, as well as all who have sketches to make for any purpose, will find cross-section paper of great usefulness in this particular. No one who uses this paper once will ever give it up.

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The Double-Acting Planer Tool Holder.

Those of our readers who were interested in the planer tool holder described in our issue of April 8th will do well to read the following additional description supplied us by the inventor:

The statement that "the actual swing of the tool is accomplished by the sliding of the tool carrier, or apron *B*, on the curved surface *c c*, whose radius is *a c*." is incorrect. The impression received is that the tool, apron and wedges are all connected and swing on radius *a c*. This is not so.

The apron *B* is pivoted, and swings on eccentric shaft *C*, forwardly and rearwardly, the forward swing being limited by stop *G* and wedge *H*, as described, and the rearward swinging movement by wedges *I I*, which you notice in Fig. 4, are entirely independent of apron *B*.

The object of providing the wedges with rearward curved surfaces, conforming to curved surfaces *c c*, is to secure for them a tilted position, and give them a solid and parallel bearing between the forward faces of wedges and rearward faces of the apron *B* at all times when the tool is in a cutting position. It is evident that if the wedges *I I* were not provided with curved faces, when apron *B* would be swung rearwardly, using pin *C* as a pivot, the rearward face of the apron would assume an angular position and would strike the bottom edges of the wedges only, but as the wedges are adjustable toward or from each other by screw *K*, they assume the desired tilted position by means of cam *L*, which is at all times necessary.

The explanation of the eccentric shaft *C* is also incorrect. The object of using an eccentric instead of a plain shaft is to secure for both cutting edges of the tool an unchanging elevation relative to the work, for it will be seen that if it were a plain shaft the forward cutting edge would be lowered during the rearward swinging movement of the tool, and the rearward cutting edge would be elevated during the forward swinging movement of the tool. But by means of the eccentric shaft and connecting levers suitably arranged, a motion is imparted from the apron and attached tool to the shaft, which causes the shaft to oscillate, thereby securing the desired result.

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Computing metals by bulk there are now but three that are cheaper than aluminum—iron, lead and zinc; copper is a little dearer.

Some More Notes on Windmills.

BY PROF. O. P. HOOD.

Under the head of "Some Notes on Windmills," Prof. De Volson Wood gave some data in the number of October 29, 1896. The subject is one of considerable interest and some importance, as the windmill is being extensively used for raising water for irrigating. In designing a pumping plant run by a windmill, one discovers problems upon which reliable data are remarkably scarce.

Professor Wood may have the impression that "the power increases nearly as the cube of the wind velocity and nearly as the square of the diameter of the wheel." Until a few pumping plants were measured I thought this was true. The statement is far from true when applied to the usual mill for pumping purposes. I found men who were designing windmill pumping plants on the basis of the power increasing directly as the wind velocity, others who believed it varied as the square, and still others who knew that the wind energy varied as the cube and expected the mill to give an output in proportion. Such was the great uncertainty based upon more or less observation of the mills in the field. When one began to measure the actual output, great variations were found in mills of the same size and make.

The following figures taken from a report of Mr. E. C. Murphy are typical and show the difference:

Two 8-foot wheels of the same make used for pumping gave velocity as follows:

Wind	8	12	16	20	25	30 miles per hour.
Mill No. 1..		10.2	19.1	25.3	28.1	25 strokes per
Mill No. 2..	8	20.2	26.1	28	27.5	minute.

It will be seen that in neither case does the increase in the number of strokes per minute vary as the cube of the wind velocity. In pumping the output would be nearly proportional to the number of strokes per minute. Mill No. 2 carried 80 per cent. more load than did No. 1.

In another case two 12-foot wheels, not the same make, gave speeds as follows:

Wind	12	16	20	25	30 miles per hour.
Mill No. 3..	4.8	12.7	18.8	23.3	25 strokes per
Mill No. 4..	6.2	11.9	14.7	16	minute.

Mill No. 3 was loaded nearly 90 per cent. heavier than No. 4. Mill No. 3 is remarkable for a high output, but its power does not increase regularly nor as rapidly as the cube of the wind velocity. It cannot be said, then, that with our modern mill used for pumping "the power will increase nearly as the cube of the wind velocity." As to the actual power developed, the following useful pumping effect was measured as the output of various mills in a 25-mile wind:

12-foot Mills	8-foot Mills
.379 Horse-power.	.043 Horse-power.
.291 "	.099 "
.309 "	.059 "
.6 "	.099 "
.247 "	.005 "
.219 "	
.184 "	

From such figures it is difficult to generalize and say that the power varies about as the diameter squared. It should be stated that these figures are actual pumping effects and therefore include the effect of a pump of unknown and variable efficiency. Even this would hardly account for the great variations. These variations are largely due to the relation of the fixed load on the mill to the most favorable load which that mill might carry at each wind velocity. Another important factor in these variations is the behavior of the regulating device which is intended to protect the wheel from too high speeds and excessive lateral pressure. If a mill could be made to stand fair to the wind at all wind velocities and have a favorable load at each velocity it might be equally efficient at each speed, and the total power might vary as the wind velocity cubed. But this is far from the condition of a mill when used for pumping. The load on a mill may be called nearly fixed. It increases slowly with the increased speed of the pump. At some particular relation of wind velocity and wheel speed this load is the most favorable load and the maximum efficiency is obtained. But with either higher or lower wind velocities this load is no longer favorable to maximum efficiency, and the mill should receive another load.

The useful work of mill No. 3 was equal to 6-10 horse-power in a 25-mile wind. Its efficiency was 5.8 per cent. In a 16-mile wind this rose to 12.1 per cent., and in a 12-mile wind fell to 10.9 per cent. The pump used in connection with this mill probably has an efficiency of over 80 per cent. at slow speed, and about 66 per cent. at the speed of the mill in a 25-mile wind. Making proper allowance for this, it brings the highest efficiency of the wind wheel at about 16 per cent. in a 16-mile wind, and 7 or 8 per cent. in a 25-mile wind.

Some measurements made in Australia of American wheels gave efficiencies from 9 to 19 per cent. in winds from 6 to 8½ miles per hour. In this country mills are not loaded to take advantage of such light winds.

As yet the subject is one in which the scanty available data are often conflicting, but enough is known to show that the mill is not equally efficient in the usual range of speeds when working with a fixed load. It is hoped that the time is not very distant when Mr. Perry will be willing to publish all of his data obtained from experimental models.

[It will be observed that the conditions of an actual windmill under varying velocities of wind are equivalent to a turbine tested under different heads, but with a fixed brake load, the turbine selecting its own speed, instead of having it selected for it by adjustment of the brake load. We take Professor Wood's statement that the power of the wheel varies as the cube of the velocity to assume that the pump resistance per stroke, or the brake load, is adjusted, as in actual turbine testing, to bring the speed of the wheel to the point of maximum efficiency for each velocity of the wind. In other words, Professor Hood's tests relate to the performance of an actual mill as now made, under varying velocities of wind; while Professor Wood's remarks relate to the possibilities of a mill when the size of the pump is adjusted to give the proper speed of wheel to each velocity of wind. A turbine, when set for use, works under a fixed head but varying load: while a windmill works under a fixed load per revolution, but a varying wind velocity or head. The difference is radical, but seems to have been lost sight of by some designers. The greatest possible output from a given mill would seem to involve an adjustment of the work of the pump per stroke to the wind velocity, by varying the stroke of the pump or by equivalent means, and there would seem to be no serious difficulty in accomplishing this.—Ed.]

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A Machinist's View of the Foundry.

BY STERLING ELLIOTT.

Much has been written concerning the foundry, though very much more has been said.

Comparatively few practical mechanics ever take the trouble to put their grievances on paper, yet they all have them, and, perhaps, no cause of trouble in the machine shop gets more verbal condemnation than the foundry.

Sometimes the poor molder is blamed for that which was no fault of his, and again, he does things which put him, for the time, outside any reasonable hope of forgiveness. When the irate machinist refers to the foundry men as "ground hogs," I don't think he really means any more than when he uses the "pronoun damn" to soothe the pain of a pounded finger, but it relieves his mind.

A foundry foreman recently told me that he found it difficult to get really intelligent boys to learn that business. Of course there are many journeymen molders who have brains and use them, while among the foremen of leading foundries are some of the best of heads. I have no fear of offending any of the fraternity, for such of them as read the "American Machinist" are no doubt able to make something beside blowholes.

Dear reader, did you ever take a nicely finished pattern into a foundry for half a dozen castings and have it come back a wreck? Did you have some tapped plates let into the top side of it and send along a set of eye-bolts with which to lift it out of the sand? And did they overlook all this and drive that blunt-pointed weapon known as the "molder's delight" into the pattern until they had made a ¾-inch hole where the wood was only ⅜ of an inch thick?

I have seen molders who could make many ordinary shapes without a pattern, and I recently saw a most perfect casting, the pattern for which was a delicate china tea cup, saucer and spoon, the three forming a single casting of iron almost equal in shape and finish to the originals; and still another instance of "gumption" on the part of a molder was a casting, the pattern for which was an ordinary grasshopper. The method by which this latter was made was as follows: The grasshopper was washed with a thin solution of clay and water. When this was dry a second coat was applied, this time a little thicker, each succeeding coat containing less water, until Mr. Grasshopper became a ball of clay, which when thoroughly dried, was placed in an oven until the clay was hardened and the unfortunate insect cremated, after which it was a comparatively easy matter to rattle out his ashes and pour in the metal. But the molders who do these things are in the hopeless minority.

The castings used in a machine are its foundation, and unless they are sound the machinist is sometimes literally building on quicksand. I have known cases in which dollars have been lost in the machine shop for the sake of saving pennies in the foundry. I believe that this should not be. The first place to spend money is in the making of satisfactory castings. If there are sufficient brains in the foundry less will be needed in the machine shop.

If good castings can be had at a moderate price, so much the better, but the question of quality should be first considered. If the more intelligent hesitate at taking hold of the founder's trade, it should be made more attractive, for there is no department of the machine business where the boy "with a head on him" can be more useful, and I believe it to be the last department wherein any false economy should be tolerated.

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Technical Books.

PRACTICAL MANAGEMENT OF ENGINES AND BOILERS; Including Boiler Setting, Pumps, Injectors, Feed-Water Heaters, Steam-Engine Economy, Condensers, Indicators, Slide Valves, Safety Valves, Governors, Steam Gages, Incrustation and Corrosion, etc. A Practical Guide for Engineers and Firemen and Steam Users Generally. By William Barnet Le Van, Consulting Steam Engineer, Member American Society Mechanical Engineers and Franklin Institute. Illustrated by forty-nine engravings. Philadelphia Book Company; 1897. 267 + XXI pages; 6½ x 4½. Price $2.

The above work is well described by its title, and lives up to it. It treats all the subjects enumerated in the plainest and most practical way. While there is scarcely a word of novelty in the book, the most essential details relating to engine and boiler management are very generally included, without any extraneous matter. The book is innocent of padding—a rare thing in technical books of the day, whether of high or low degree.

THE MATERIALS OF CONSTRUCTION. By J. B. Johnson.; 787 6 x 9-inch standard pages, with 635 engravings and eleven full-page plates. Wiley & Sons. Price $6.

This book is divided into four parts, the first treating of the strength of materials, the second of the manufacture and properties of the materials of construction, the third of testing machines and methods of testing materials, and the fourth of the mechanical properties of the materials of construction as revealed by actual tests. The book is a more comprehensive résumé of the subject which forms its title than we have seen between one pair of covers before. It is up to date and gives the latest views, apparatus and results of researches; the structure of the materials as revealed by the microscope being treated quite fully and forming the subject of many of the full-page plates. Not the least valuable feature of the book is a full and complete index.

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Personal.

Chief Engineer R. Potts has been placed on the retired list.

Passed Assistant Engineer R. B. Wiggins has been detached from the "Texas," and ordered to the "Amphitrite," and Passed Assistant Engineer E. M. Bennet has been ordered from the "Amphitrite" to the "Texas."

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Questions and Answers.

Name and address of writer must accompany every question. Questions must pertain to our specialties and be of general interest. We cannot undertake to answer questions by mail.

(46) ——, St. Louis, Mo., asks: Which is the proper position for the key-seat in a split pulley? Should it be placed in the split or at right angles with the split? A.—The best engineers have found out that keys are not required, and do not use them. For those who insist upon the key, probably the best position for it is 45 degrees from the joint.

(47) C. E. P., St. Petersburg, Russia, asks for a lubricant for use in lathes, milling machines, etc., which will not rust the work. A.—For heavy work on steel, such as cutting screws, good lard oil should be used, and will well repay its cost over other lubricants. For much other work, water with sal-soda dissolved in it is used. If sufficient soda is used, it will not rust the work.

(48) N. S. D., Toronto, asks for a suitable galvanic battery for use with oil and gas engines, to produce the ignition spark. He has used the Léclanché and Gonda, but with poor results. A.—We should not expect an open-circuit battery like the Léclanché to be able to maintain itself under such frequent use. We believe the Edison, Gordon and Samson are used successfully.

(49) "Steelworker," Worcester, Mass., asks if it is possible to weld Mushet or other self-hardening steels. A.—It is impossible to weld self-hardening steel with the hammer, as when heated hot enough, it goes to pieces. It can, however, be welded to iron under a press. The iron should be heated to a good high heat, and the self-hardening steel to about a yellow or good forging heat. Nail-cutting knives have been made in this way, and have done good work.

(50) E. R. W., Buffalo, N. Y., asks: How is the paper prepared for taking indicator cards with a brass wire? A.—The use of a fine brass wire point instead of a lead pencil is recommended by Mr. Chas. T. Porter in his valuable treatise on the steam engine indicator. In Mr. Porter's practice he used what is known as "metallic" paper, a peculiar paper of English manufacture. Mr. Porter does not now advocate the use of the brass wire, as the leads and means of holding them have been so greatly improved. Cards traced with the wire point possess the one, sometimes important, property of being not easily tampered with or doctored.

(51) C. H. G., Milwaukee, writes: I have had a little dispute with a friend about aluminum. He says that it will break, but will not bend, and as I had a piece of it, I showed him that it would do both. He claimed that the piece I had was not genuine aluminum. Please show that I am either right or wrong. A.—Aluminum may be forged or rolled as easily as gold or silver; it is easily drawn into wire; its elasticity is nearly the same as silver. Alloys of aluminum may be produced that will be brittle, but it is no more proper to say that it will break than that gold or silver or copper will break, although they all will break under certain conditions.

(52) M. S. T., Jackson, Mich., asks: 1. Can you give me a receipt for a quick-drying cement or glue that will stick leather and pasteboard or felt together. A.—It might be well to try the following; we, of course, have not tried it: Bisulphide of carbon, 10 parts; oil of turpentine, 1 part; dissolve in this enough guttapercha to form a paste. The surfaces to be connected should be free from grease, and should be warmed and held together by pressure until dry. 2. I want also a cement that will stick leather to iron; this need not be quick drying. A.—Dissolve good glue in hot vinegar with one-third of its volume of white pitch. This is said to be good for fastening any fibrous material to iron or other metal.

(53) P. E. Newton, N. J., writes: We have a cast-iron anvil with steel face, which has been through a fire. It is in good condition, but, of course, the face is soft. Can you give me instructions for tempering it without sending it to the works where made? Is there any danger of cracking? A.—The only difficulty about hardening the face of an anvil is in cooling it with sufficient rapidity. Merely dropping it in cold water will not do it. The precise arrangement adopted must be determined by the facilities that can be procured. The anvil should be heated to the proper heat, and then quickly placed in water of sufficient depth to cover it, and with a strong current in the water striking upon the face to be cooled. The rapid current might be from the hose of a fire engine or its equivalent, or it might be the fall of water over a dam. With a suitable tank and sufficient water, the water might be set in motion by an extemporized paddle-wheel driving the current against the face. If the anvil was heated slowly and carefully, there should be little risk of cracking it.

(54) F., Montreal, asks: 1. What taper, if any, is considered best for hardened steel mandrels to take work with straight reamed holes? Should part of the mandrel be straight, or should it taper the whole length to be up to best practice. A.—The mandrel should be slightly taper,

say 1-16 inch to the foot, and a bushing with a hole of the same taper, and parallel on the outside, the exact diameter of the hole in the piece to be held, should go with it. The bushing should be slit completely through one side, and then, when the mandrel is driven in, the work will be held true and tight. 2. Is it considered good practice to polish or grind such work as wrought iron or steel shafting either with emery in the lathe or in the universal grinder, with or without oil or water? Is there the same trouble with brass and cast iron? Is there any way to avoid such results, or are they imaginary? A.—It should be scarcely necessary for any constant reader of the "American Machinist" to ask such questions. It is not only good practice, but the best practice to finish journal surfaces upon the universal grinder, and preferably with water, never with oil. Cast iron may be ground as well as steel. Close iron should be used, and no blow-holes allowed. Brass is not so generally ground, and generally does not require it, and would not be improved by it.

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A fine specimen of modern lathe work is shown in six monolithic polished granite columns over three feet in diameter and twenty feet high in the front of a new building on Broadway.

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Commercial Review.

NEW YORK, SATURDAY EVENING, APRIL 17.

THE MACHINE TOOL MARKET.

Local reports of the iron working machinery market are of much the same tenor as those which have gone before. The amount of business is moderate, and some of the sellers fail to see that the advancing season has brought any better trade for the past four weeks than during those immediately preceding. However, there are others who report improvement, and without attempting definitely to estimate the quantitative relations of the two periods, it may be said that the more recent is not improbably the better.

A gentleman whose opinions on the machine-tool trade are generally as fair as those of anyone whom we know, states as his belief, that the business of this year is better than that of the first part of 1896, if bicycle-making machinery be left out of the question. At that time things were hustling in that particular line, and consequently those who engaged in it considered trade to be moving along swimmingly, while those manufacturers who continued to confine their attention to the old and well-established lines of work were despondent. The real tone of business ought, it would seem, to be judged by the sale of standard lines of goods for ordinary purposes; and if, as the party referred to believes, the machine-tool trade of that nature is better than it was last year, it appears to indicate that the market is fundamentally stronger than at that time.

The same party, who has been entering somewhat into the second-hand tool business recently, says that this class of machinery finds a good market, and that he has been encouraged to continue with it. The larger tools, one would think, should sell the best, they being the greater bargains; but, as a matter of fact, those which are the most readily taken up are the odds and ends, which a seller is glad to dispose of.

The following opinion does not sound quite so favorable, and it comes, too, from a dealer well qualified from his class of business, to feel the pulse of the general market: "It has never been duller than now. People talk of business improvement, but I say that there is none. I do not see how trade will have a chance to change before summer, and then by the time fall comes, some new idea will have entered people's heads to retard prosperity."

The bicycle makers are now engaged in manufacture, and of course not much demand for machinery is to be expected from them so late in the season as this. The Pope Manufacturing Company have, indeed, been putting in a few new machines. A person engaged in the cycle fitting business says that the high-class wheels are finding a good market, but that it is otherwise with inferior grades.

We are informed by a party who has lately visited the machine shops of Massachusetts, that some activity in machine tools is taking place in Worcester, although there is a marked contrast in the present business of different companies, of which there are several who are being rushed with orders while others are doing practically nothing. But, on the whole, a fair proportion of the tool-builders in that center of industry are busy, and the best part of it is that considerable of the work is for domestic account. We hope that we may be pardoned if we allude to some companies who are especially reported active. They include Prentice Brothers, whose home trade, as a decidedly favorable fact, is said to be better than their foreign, and who are making lathes, etc.; the F. E. Reed Company, home and foreign trade about equal, also making a number of lathes; P. Blaisdell & Co., who have some orders for drills, and the Powell Company, planers. Some business is reported through another channel, at Springfield, Mass.

A certain concern which manufactures a large assortment of machine tools, and sometimes indulges in special machines, reports that orders seem to be better, but that those received have been for specialties rather than for the general lines. Some improvement is manifested in the West, and a few contracts have come from abroad. An interesting order received by them within the last two weeks was for 100 dynamite guns for Turkey. We wish that we were at liberty to mention the name of the company referred to, but they fear that, if we did, their customers would imagine that they keep dynamite on the premises, and be deterred from calling.

A member of one of the largest machine tools firms in this country delivered to us his opinion thus: "To be perfectly frank, trade in machine tools has not become any better within the last four weeks—rather the contrary. As to demand from the railroads for machinery, how can they buy when their earnings are so small as at present? Business moves gradually. A month is too short a time in which to look for a change. Comparisons must be made year by year, and even irrespective of the bicycle tool trade, I do not consider this season as good as the corresponding period last year. Some people are bulls one day and bears the next. They happen to get an order that would not be large enough to signify much with us, and they think that business has begun to boom. It reminds me of the following incident: A company with which I was connected was employing a young man from the West. There was nothing for him to do at home, and we were paying him $5 per day. Once he came to us and said: 'I guess I'll have to leave and go back. Business out there has begun to improve. My brother writes me that he has sold two plumb bobs.'"

But after all our informant thinks that the undertone of business is growing stronger, because of a prospective settlement of the tariff question. For the last two or three years he has been a bear, and he thinks that it is now about time to become a bull.

WOOD-WORKING MACHINERY.

The wood-working machinery trade has not fulfilled hopes that were aroused for it earlier in the season. Companies who a number of weeks ago were having a good run of orders find that they have dropped off. One of the largest concerns reports that the last few days have shown a recovery, after an intermediate period of relative quiet; another makes the somewhat equivocal statement that it is doing a fair business considering the state of the times.

WHAT MR. MCKINLEY THINKS.

This is a matter which is somewhat out of our usual custom to allude to, but considering that the words in question, since they fell from his own august lips, have never, so far as we are aware, been defiled with printers' ink, we can afford to throw out a thousand-dollar ad. or so, to make room for them. Said he: "The way I want to help all these people who are after offices is not by giving them government positions. Just let that tariff bill get through and out of the way, and they will be finding employment before they know it, and will not need to come to me." Our informant, to whom the words were addressed, a gentleman of machine-tool proclivities, reinforces them by saying that whether the bill be in all points a commendable one or not, he has considerable hope as to the result of a settlement of the issue.

(Continued on page 38.)

Business Specials.

Gear wheels, gear cutting. Grant; see page 16.

Forming Lathes. Mer.Mach.Tool Co., Meriden,Ct.

Good gear cutter for sale cheap. B. V. Covert, Lockport, N. Y.

Engine Castings ⅛ to 2 H. P. Finished boilers and engines. Grant Sipp, Paterson, N. J.

Send $1 to the Tabor Mfg. Co., Elizabeth, N. J., for improved stop-motion revolution counter.

Selden Packing for stuffing box, with or without rubber core. Randolph Brandt,38 Cortlandt st.,N.Y.

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Wants.

Situations and Help Advertisements only inserted under this head. Rate 30 cents a line for each insertion. About seven words make a line. The Cash and Copy should be sent to reach us not later than Saturday Morning for the ensuing week's issue. Answers addressed to our care will be forwarded.

Situations Wanted.

A mech. eng., grad. of a Ger. univ., wishes pos. as draftsman; mod. sal. Box 170, Am. Mach.

Position as supt. or foreman by an up-to date hustler; engines or pumps. Box 176, Am. Mach.

Sit. as foreman by thorough machinist; have had charge; references. Box 180, Amer. Machinist.

Mech. draftsman desires posi. draft. or pat shop foreman; 20 years' exp. Box 185, Am. Machinist.

Wanted—Draftsman and machinist, 12 years' exp., desires a change. Address Box 182, Am. Mach.

Experienced mechanic and designer of machinery and tools desires position as superintendent or designer. Box 181, American Machinist.

All-round machinist and tool maker, experienced in modern methods and machinery, designing of special tools, wants position. Box 178, Am. Mach.

The services of an expert designer of printing machinery, including 2-revolution and stop-cylinder machines may now be secured. For interview, address Box 179, American Machinist.

A tech. grad., having 5 years' experience in pattern shop, machine shop and drafting room, desires position; drafting preferred. References as to ability and business habits. Box 184, Am. Mach.

A position wanted by a young man; tech. educ. and 5 years experience with machine tools, as traveling salesman for some dealer or mfgr. or iron and steel dealer. Box 177, American Machinist.

Wanted—Position as supt. or salesman. Experience hoisting, mining, Corliss steam engines and general heavy machinery; good designer; good ref. N. Y. representation pref. Ad. Box 183, Am. Mach

Wanted—Posi. as supt. or designer by young man thoroughly familiar with all kinds of rubber working machinery. At present with one of oldest builders in U. S. Address Box 175. Am. Machinist.

Mech. eng., 30, wide experience and education, mem. A S M.E., owns valuable pats. on gas engs. for direct cpld. elec. serv., desires con. with subtl. concern needing eng. or supt. Box 161, Am. Mach.

Sit. wanted as foundry foreman; 10 years' exp. A practical mold., acquainted with gen. work, both heavy and light; understands the mix. of irons and handling of men. Add "Molder," Am. Machinist.

Help Wanted.

Help Wanted—Good pay for leisure hours. Geo. W. Lord, Philadelphia, Pa.

Wanted—George H. McDonald to write to Caleb Miller, No. 1 Fenchurch Street, Norfolk, Va.

Wanted—Mould maker with thorough experience in all kinds of rubber mould work. Address Box 172, American Machinist.

Draftsman and Designer—prac., competent and experi. in heavy and light machine tools. State age, experience and salary. Box 174, Am. Machinist.

Wanted—A thoroughly competent man who understands case hardening, tempering and the treatment of steel, to take charge of the hardening dep't in a large bicycle factory. Address, stating age, exp., ref. and sal. expected. Box 173, Am. Mach.

Miscellaneous Wants.

Advertisements will be inserted under this head at 30 cents per line, each insertion. Copy should be sent to reach us not later than Saturday morning for the ensuing week's issue. Answers addressed to our care will be forwarded.

Cheap 2d h'd lathes & planers. S.M.York,Clev'd,O.

Calipers & Gauges. F.A.Welles, Milwaukee,Wis.

The Dutton Wet Twist Drill Grinder is sold by the Garvin Machine Co., New York City.

For Sale—Otto 6 H. P. gas engine; excellent condition. Frank H. Chisholm, Bloomington, Ill.

Best and cheapest Bolt Header, made by Baush & Harris Machine Tool Co., Springfield, Mass.

Models, experimental and small special machy. built. Write to Crocker & Lawson, Binghamton, N.Y.

Light and fine mach'y to order; models and electrical work specialty. E. O. Chase, Newark, N. J

For Sale—Second-hand drill presses, engine lathes & planers. Dietz, Schumacher & Boye, Cincinnati, O.

To Let—First and second floors 93 John Street. Space about 4,000 square feet. Rent $2,000. Apply Jessops, 91 John Street.

We make a specialty of Shartle's patent safety set collars. Prices low and samples free. Middletown Machine Co., Middletown, Ohio.

Wanted—Every reader of this paper to send 35 cents for The Tool Catalogue. See Montgomery's advertisement on page 15 of this edition.

Model Locomotives—Complete castings, latest N. Y. Cen. standard, up to date; 4c. in stamps for catalog. G. H. Olney, 163 Herkimer St., Brooklyn, N. Y.

Wanted—An Idea. Who can think of some simple thing to patent? Protect your ideas; they may bring you wealth. Write John Wedderburn & Co., Patent Attorneys, Washington, D. C., for their $1,800 prize offered to inventors.

Wanted—To correspond with parties having article of manufacture now made on contract which could be further developed under the favorable conditions we have to offer. Would also like to hear from firm open to change whereby an established bus. may be increased. Cheap power and low rents, or increased capital if investigation warrants. Confidential. Address, Board of Trade, care Am. Mach.

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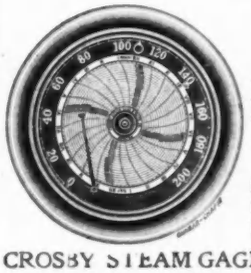
FOR ADVERTISEMENT OF
TIGHT JOINT CO. NEW YORK,
See Issue of April 1, 1897.

BRANDEN



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WILSON MITCHELL, 310 N. 4th St., Phil., Pa.
Send for "Grinding instead of Planing."

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Ideal Grinder for taper, shell and shank reamers, edge or bevel cutters, any kind of mills. Grinds hollow mills up to 6 in. diameter, reamers 14 in. long, 4½ in. diameter.

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J. J. McCABE, New York. HILL, CLARKE & CO., Boston.

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DON'T SPOIL IT
BY GUESSING.

Use the Richards' System of measuring machines; these Gauges are guaranteed to $\frac{1}{10000}$ of an inch.
Implements are adjusted at a temperature of 75°.

ASK FOR NEW RED BOOK.

The John M. Rogers, Boat, Gauge & Drill Works,
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ACCURACY ACCURACY ACCURACY

We Claim that it will do more work than any similar tool in the market. No danger of breaking tools.

Never back live spindle.

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THE UNION TIRE CO.
PLAINFIELD, N. J.

MAKERS OF
THE FULMER
Drilling and Tapping Attachment.

Drills and taps holes either through or bottom, without reversing or stopping machine.

(Continued from page 36.)

MACHINERY AND CYCLE EXPORTS FOR FEBRUARY.

The Monthly Summary of Finance and Commerce, prepared by the United States Treasury Department, shows, among exports of domestic merchandise, that machinery, including engines, boilers, printing presses, typewriters, sewing machines, etc., was send abroad during February, 1897, to the amount of $2,211,562, as compared with $1,899,903 for February, 1896. For January, 1897, the amount was $2,328,201. The eight months ending February, 1897, reached a total of $18,748,361, against $13,580,631 for the corresponding eight months a year previous. A comparison of the amounts for February and January of this year shows some falling off, which corroborates what we have stated as having inferred from reports of a general nature for some months past. The statistics of shipments now available correspond to orders taken in quite a while ago, and it must not be inferred that at the present time export demand is on the decrease.

The exports of cycles and parts of cycles were as follows: For February, 1897, $565,743; February, 1896, $147,819; January, 1897, $480,992; eight months ending February, 1897, $3,188,466; eight months ending February, 1896, $480,722.

Quotations.

NEW YORK, Monday, April 19.

Iron—American pig, tidewater delivery:

No. 1 foundry, Northern	$12 00 @$12 50
No. 2 foundry, Northern	11 25 @ 11 75
No. 2 plain, Northern	10 50 @ 10 75
Gray Forge	10 25 @ 10 50
No. 1 foundry, Southern	10 75 @ 11 25
No. 2 foundry, Southern	10 25 @ 10 50
No. 3 foundry, Southern	10 00 @ 10 25
No. 1 soft, Southern	10 50 @ 10 75
No. 2 soft, Southern	10 25 @ 10 50
Foundry forge, or No. 4, Southern	9 50 @ 10 25

Bar Iron—Base—Mill price, in carloads, on dock: Common, 1.00 @ 1.10c.; refined, 1.10 @ 1.25c. Store prices: Common, 1.25 @ 1.35c.; refined, 1.35 @ 1.50c.

Tool Steel—Ordinary sizes, standard quality, 6 @ 7c., with some brands perhaps a little less; extra grades, 11 @ 12c.; special grades, 16c. and upward.

Machinery Steel — Ordinary brands, from store, in small lots, 1.50 @ 1.60c.

Cold Rolled Steel Shafting—Base size, 2.50 @ 2.55c., in small lots, from store.

Copper—Carload lots, Lake Superior ingot, weak at 11½c.; electrolytic, 11 @ 11¼c.; casting copper, 10¾ @ 11c.

Pig Lead—In carload lots, 2.32½ @ 3.35c., f. o. b., New York.

Pig Tin—For 5 and 10-ton lots, 13.30 @ 13.35c., f. o. b.

Spelter—In carload lots, New York delivery, 4.10c., f. o. b.

Antimony—Cookson's, 7¼ @ 7½c.; Hallett's, 7c.

Lard Oil—Prime city, present make, commercial quality, in wholesale lots, 38 @ 40c.

▲ ▲ ▲

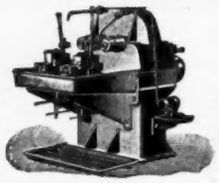
New Catalogs.

There are three sizes of Standard Catalogs, first authorized by the Master Car Builders' Association, 9" x 12", 6" x 9" and 3½" x 6". We recommend the 6" x 9" size for machinery catalogs. When they must be larger or smaller, one of the other standard sizes should be adopted if possible.

The Pancoast Ventilator Company, Philadelphia, Pa., send us catalog of ventilators. This catalog is 4½ x 5½ inches.

The Hall Steam Pump Company, Allegheny, Pa., send us a catalog of single and duplex air compressors. It is 7¾ x 10½ inches.

(Continued on page 39.)



Automatic Solid Die Bolt
THREADING MACHINES.
Two Styles. Four Sizes.
Send for Catalogue "A."
Webster & Perks Tool Co.
Cor. Spring and Monroe Sts.,
Springfield, Ohio.

Hub Ball Bearings
FOR
Drill Spindles.

They are superior to fibre washers in point of durability, and to steel and bronze collars by reason of their anti-friction qualities.
Larger holes may be drilled on the same machine if provided with these Bearings.

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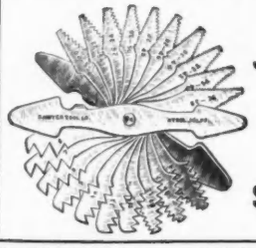

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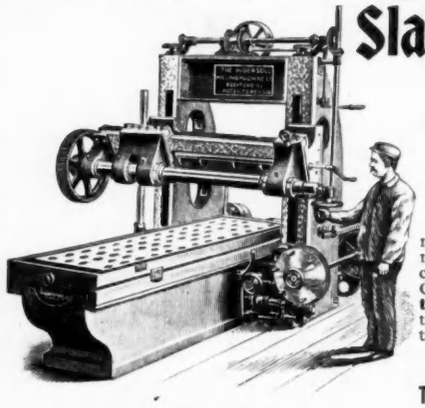
ATHOL, MASS.



Slab Milling Machines
EXCLUSIVELY.
Horizontal or Vertical Spindles.

SIZES:
15", 20", 24", 36", 48", 60", any length.

Ten Years' experience in building this type of milling machines **exclusively,** has pointed out to us many valuable features about slab milling machines, which are **incorporated only in our designs.** One of our milling machines will do the work of **three planers always.** Many times a greater ratio than this. Write for catalogue and full information.

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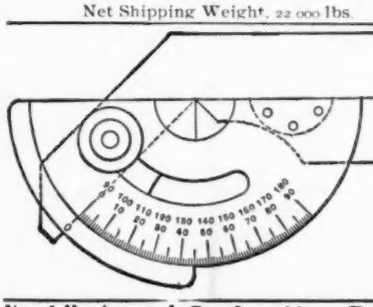
Cable address, "Ingersoll," Rockford.

36" x 36" x 8' Slab Milling Machine.
Net Shipping Weight, 22 000 lbs.



New Bevel Protractors.
Reduced prices on our Machinists' Rules.
Send for Catalogue.
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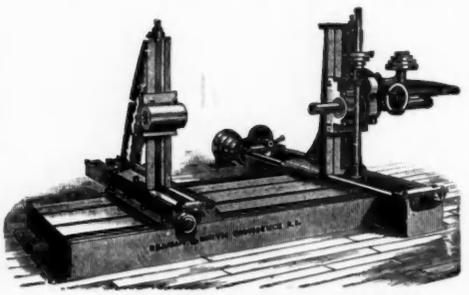
No. 1 Horizontal Spindle Drilling and Boring Machine



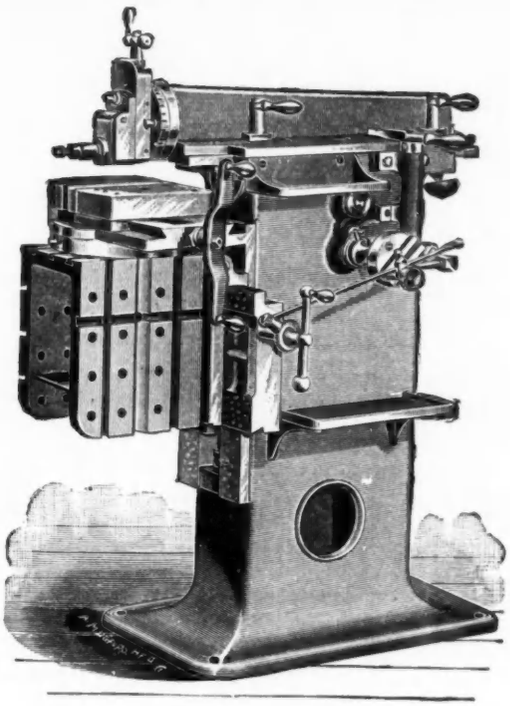
A CONVENIENT, EFFICIENT TOOL.

CAPACITY.
The greatest distance from top of platen to center of spindle is 40"; the least 10". Vertical movement of spindle 30" Horizontal 40". Greatest distance from spindle head to outer support is 70". Spindle has automatic feed of 31".

PLATEN
is heavy and well ribbed; 40" wide, 84" long.

WEIGHT, 6,500 LBS.

BEAMAN & SMITH, Providence, R. I.



..IMPROVED..

15-inch Hendey Shaper.

Latest Improvements.
Useful Attachments.
Strong and Powerful.

...FOR...

Die Work, Tool Room or General Shop Work.

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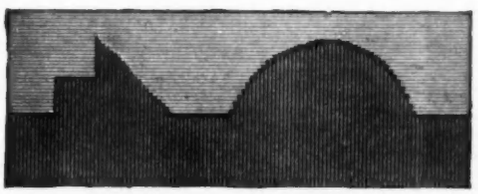
The stroke can be adjusted for curves with machine in motion. The stroke can be adjusted for angles with machine in motion. The stroke can be adjusted for irregular work with machine in motion. It has adjustable table for planing taper work; table can be removed for fastening work to apron. Has a strong graduated swivel vise. Quick work, rapid changes, modern ideas.



This cut shows how stroke can be adjusted with machine in motion by micrometer; adjustment fine and delicate. SEND FOR CIRCULAR.

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European Agents, { **CHAS. CHURCHILL & CO., London and Birmingham.**
SCHUCHARDT & SCHÜTTE, Berlin and Vienna.
EUGEN SOLLER, Basel, Switzerland.

(Continued from page 38.)

Nelson-Newman Company, Chicago, Ill., send us a catalog containing illustrations and descriptions of the N. & N. reversible grate bar. It is 8 x 5 inches.

W. L. Stewart, Wilmerding, Pa., sends us small catalog devoted to the illustration and description of the Stewart Cycle Brake. It is 3¾ x 5¾ inches.

The Armington & Sims Engine Company, Providence, R. I., send us a pamphlet relating to their self-oiling heavy-duty engine. The pamphlet is 6¼ x 9½ inches.

A. B. Jardine & Co., Hespeler, Ont., Canada, send us catalog "J" of taps, dies, drills and other machinists' and blacksmiths' tools. The catalog is standard size, 6 x 9 inches.

We have received from P. F. Olds & Son, Lansing, Mich., a catalog of gas and gasoline engines. In the catalog is included several testimonial letters, and it is 5¼ x 8 inches.

Garvin Machine Company, New York, send us catalog and price list of machine tools, a portion of which is devoted exclusively to machines used in the manufacture of bicycles. The catalog has 158 pages and is 4 x 6 inches.

Hill, Clarke & Co., Boston, Mass., send us a copy of their machinery blue book and catalog, in which are given illustrations and descriptions of all kinds of machine tools. The book has 402 pages, and is standard size, 6 x 9 inches.

We have received from the Peerless Rubber Manufacturing Company, New York, catalog No. 24, devoted to the illustration and description of all kinds of rubber supplies, including hose, rubber valves, packing, etc. It is 5¾ x 8¼ inches.

The Rollins Engine Company, Nashua, N. H., send us a catalog devoted to the illustration and description of the improved Rollins automatic cut-off engine. Engravings of the various parts of these engines are shown, along with indicator cards taken from them. The catalog is 7¼ x 10 inches.

James L. Robertson & Sons, 204 Fulton street, New York, send us a catalog which contains illustrations and descriptions of indicators, filters, planimeters, etc. Those interested may obtain a copy of this catalog by sending name and address to Robertson & Sons. It is 6 x 9¼ inches.

Edward Smith & Co., of 45 Broadway, New York, send us a handsomely gotten up standard size catalog, 6 x 9 inches, on paints, varnishes and enamels for protecting iron and steel structures. The pamphlet is chiefly a reprint of recent papers before engineering societies on this subject, and gives a large number of well made and half-tone engravings of important structures to which their preparations have been applied.

Eugene Dietzgen & Co., Chicago, Ill., send us a pamphlet illustrating the Cochrane parallel rule, which is an appliance for the drawing board by which parallel lines are drawn without a T square, and which, at the same time, permits a straight edge to be set at any required angle readily when desired. This pamphlet also illustrates a useful device called a scale marker, which is an attachment to the ordinary draftsman's triangular scale, by which a needle point is made to puncture the paper at the exact zero point of the scale, thus facilitating the accurate setting off of distances.

▲ ▲ ▲

Manufactures.

C. F. Pekor, Columbus, Ga., will place new machinery.

At Rock Rapids, Ia., a new electric-light plant is to be erected.

The Jonesboro (Tenn.) Cotton Mills is adding new machinery to its plant.

The Merrow Machine Works, of Hartford, Conn., are erecting a new plant.

The Albany (N. Y.) Felt Company contemplate the placing of new machinery.

The works of Abram Cox at Lansdale, Pa., are to have an addition erected shortly.

Arbuckle Bros., Brooklyn, N. Y., contemplate the erection of a new sugar refinery.

At Reading, Pa., the Acme Manufacturing Company will begin to enlarge their plant.

The plant of the Samson Cordage Company, at Shirley, Mass., was recently destroyed by fire.

The plant of the Poughkeepsie (N. Y.) Glass Company, recently burned, will be rebuilt at once.

The Logan, Swift & Brigham Envelope Company, of Boston, Mass., will add to their plant.

Mr. M. H. Houser intends to place new machinery in his flouring mill at Pomeroy, Wash.

At Malone, N. Y., Thomas Hinds has purchased the Malone foundry and machine shops.

The E. E. Souther Iron Company, of St. Louis, Mo., will add new machinery to their plant.

The Riverside Machine Works, Kokomo, Ind., owned by Apperson Bros., will be enlarged.

The Swift Packing Company, of Chicago, Ill., contemplate the erection of a new lard refinery.

The Carr Milling Company, of Hamilton, O., contemplate the erection of a flour mill at that place.

The Lancaster Mills Company, Clinton, Mass., contemplate the addition of machinery to their plant.

The sawmill plant of the Canfield Lumber Company at Canfield, Ark., has recently been destroyed by fire.

The Bellaire Steel Company, Bellaire, W. Va., contemplate the erection of new buildings to their plant.

Schroder & Jorgenfens, Copenhagen, Denmark, are in the market for small lathes and other machine tools.

At Easton, Md., Mr. William H. Withgott has purchased the school-house, which he will convert into a machine shop.

At Portsmouth, O., the Imperial Mills Company, of which G. Frick & Sons are proprietors, contemplate some improvements.

The plant owned by the St. Louis Refrigerator & Wooden Cutter Manufacturing Company, St. Louis, Mo., has been destroyed by fire.

At Philadelphia, Pa., Mr. Bear contemplates the erection of a new building at 932 Race street, to be used for light manufacturing purposes.

At St. Louis, Mo., the American Corrugating Company has been formed. Mr. R. B. Whittemore is president, and A. P. Whittemore secretary.

The Flour City Molding Works, of Rochester, N. Y., has been formed. Messrs. H. B. Hathaway of Rochester, and Thos. Ferguson, of Brooklyn, N. Y., are interested.

At Omaha, Neb., the Templeton Manufacturing Company has been formed with a capital of $50,000. The company will establish a plant for the manufacture of motors.

At Reading, Pa., the Reading Steel Company has been organized, with a capital of $200,000. Messrs. C. G. Smith, E. B. Leaf, J. S. Robeson and others, of Philadelphia, are among the incorporators.

John W. Quincy & Co., pig iron dealers, who for forty-five years past, with the exception of the last one, have been located on the corner of William street and Maiden lane, New York, have returned to take offices in a new twelve story building, the Woodbridge, which covers the site of their old stand.

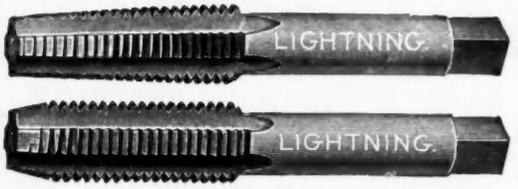
The Pratt & Whitney Co. HARTFORD, CONN., U.S.A.

...MAKERS OF...

Fine Machine Tools.

Complete Plants furnished for Bicycle, Typewriter, Gun and Sewing Machine Makers. Gauges and Small Tools for all Machine Work. Drop Hammers and Trimming Presses. Forging and Trimming Dies for all classes of work.

England—BUCK & HICKMAN, 280 Whitechapel Road, London, E. *Chicago*—42 and 44 South Clinton Street.
France—FENWICK FRERES & Co., 21 Rue Martel, Paris. *Boston*—281 Franklin Street.
New York—123 Liberty Street.



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Machine Relieved Taps.
ALSO DIES, SCREW PLATES, REAMERS, Etc.
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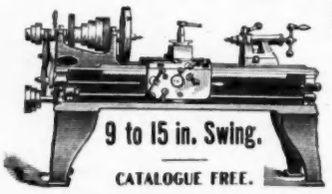
8vo, Cloth, $4.00. Nearly 400 Pages, 142 Illustrations.

JOHN WILEY & SONS, 53 East 10th Street, New York.



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★★★
Foot Power Screw Cutting, Automatic Cross Feed, 9 and 12" Swing.
Send for Catalog B.
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IS the Perfection of Joint Packing. Instantaneous, **Does Not Squeeze Out** and not necessary to follow up joint. We guarantee it to last for years on any and all pressures of steam or any kind of joint where packing is required. Does not rot, burn or blow out, therefore the best for all purposes. Call for and insist on having '96 JENKINS '96, stamped like cut. . . . . .

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THE PANCOAST VENTILATOR.
HANDSOME, STRONG, DURABLE, EFFICIENT.
Leads them all in giving the best of Ventilation.
Houses, Mills, Factories, School-Houses, Churches, Refineries and *Foundries* use them with perfect results.
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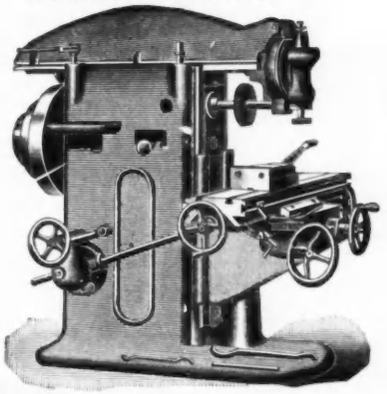

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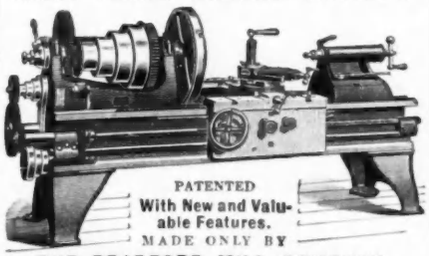

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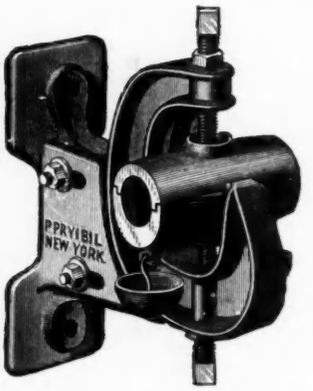

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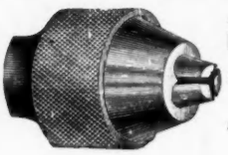

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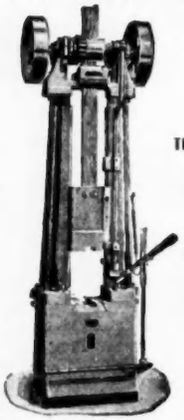

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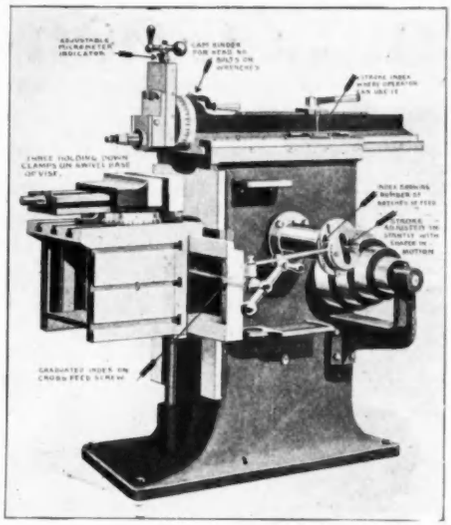

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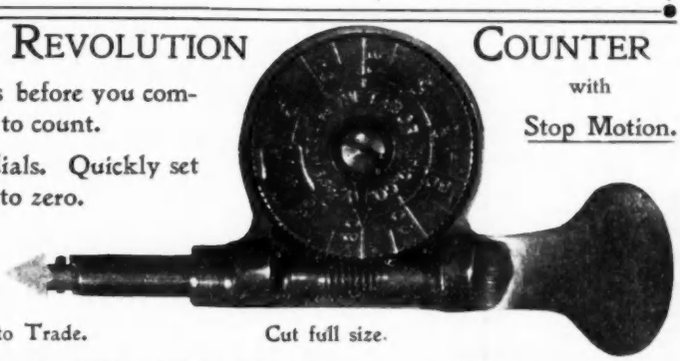

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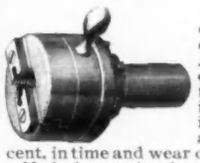

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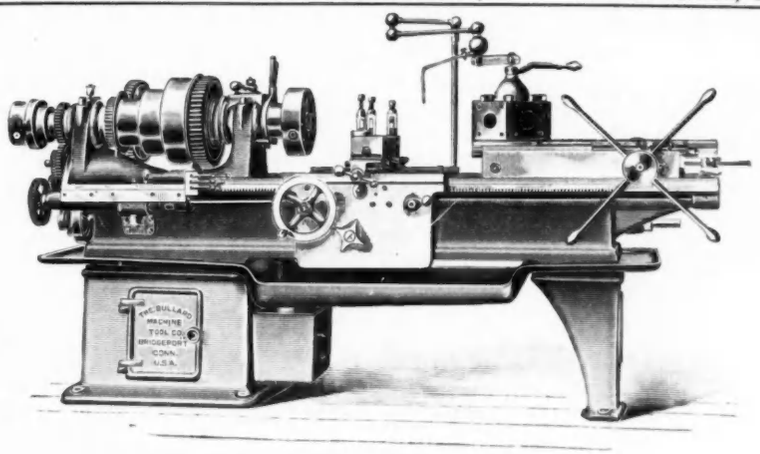

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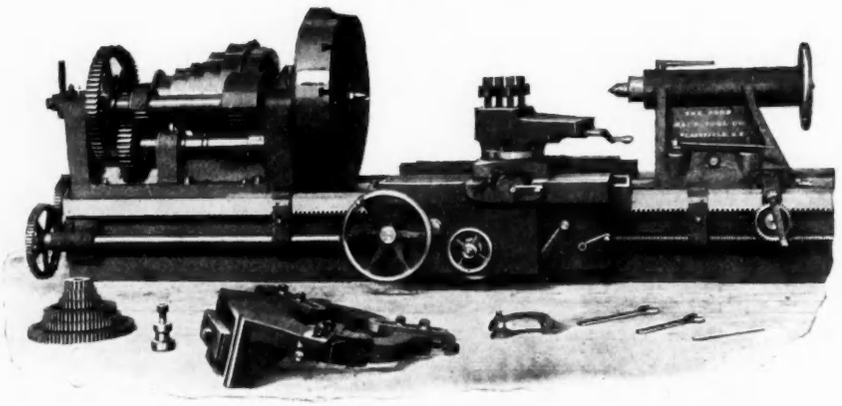

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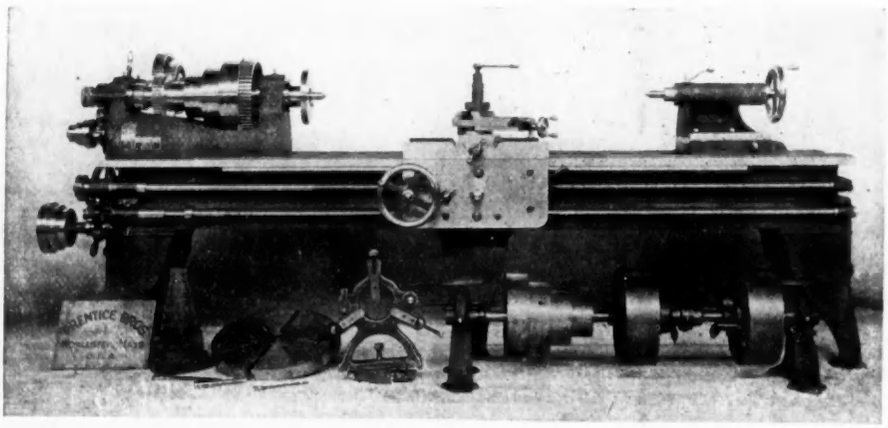

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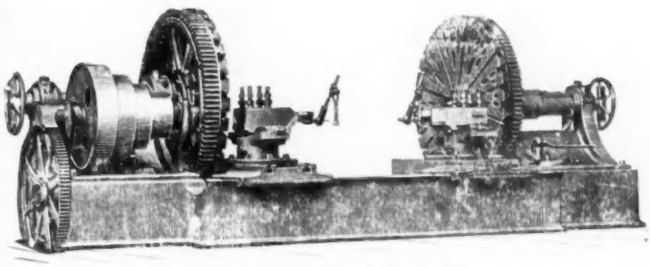

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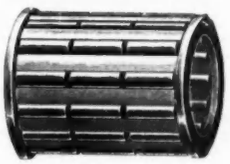

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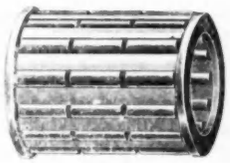

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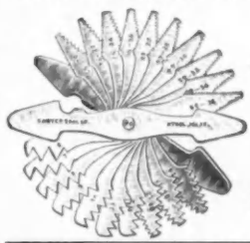

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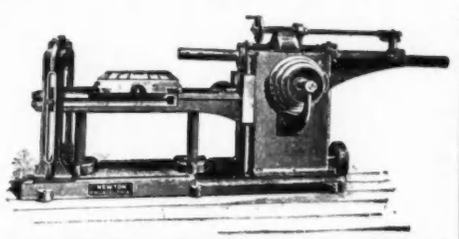

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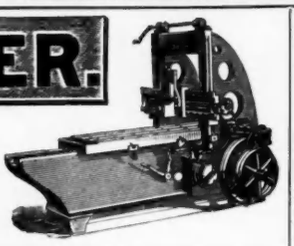

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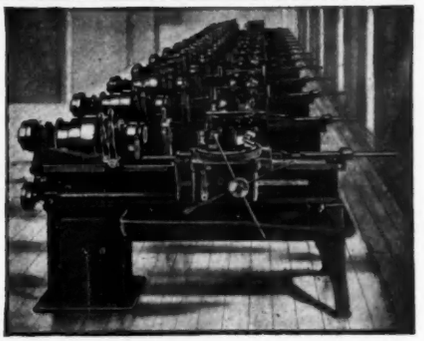

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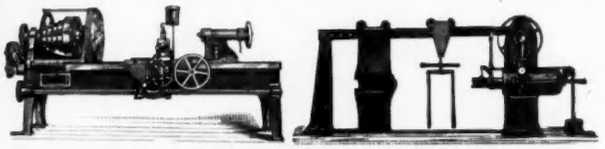

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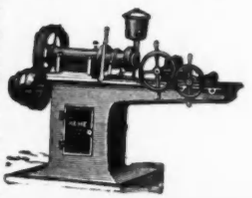

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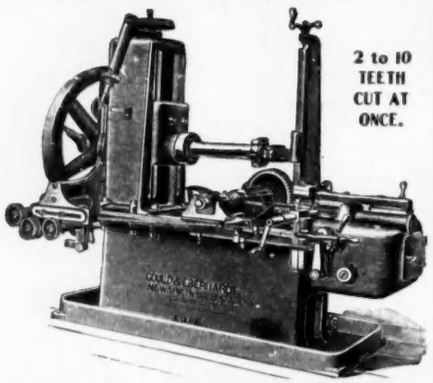

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